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From the Desk of Editor-in-Chief

I am thankful to the authors and contributors of the scientific articles and research papers being published in this issue of the Journal of Punjab Academy of Forensic Medicine & Toxicology. I am also thankful to the editorial team for supporting me in publishing this issue and the members of the Academy for giving me the opportunity to serve for the second term.

The journal has entered in the 14th year of its publication and it is now covered by **Elsevier products (Scopus), Med-Ind and DOAJ** and cited with **Index Copernicus** and many other citing bodies namely **Safetylit, Worldcat library, J-Gate & WHO Hinary**.

My special thanks to Dr Anil Garg, Joint-Editor for his support and sincere efforts for timely publication and release of this issue.

Any suggestions and advice for further improving the standards and quality of the journal will be appreciated.

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Editorial

HISTORICAL JOURNEY OF GAY TO INDIAN MEDICO - LEGAL CORRIDORS

The Supreme Court of India on 11-12-2013 reinstated a colonial - era ban on gay sex that enables the jailing of homosexuals, a major setback for rights campaigners in the country. A bench of Justice GS Singhvi and Justice SJ Mukopadhyaya reversed a landmark 2009 Delhi High Court ruling which said that Section 377 IPC prohibiting voluntary carnal intercourse 'against the order of nature' with any man, woman or animal infringed upon the fundamental rights of Indians.

The ruling stunned many rights activists who expected the court to uphold the High Court verdict or refer the matter to a bigger bench. The ramification of the verdict is not restricted to members of the LGBT (lesbians, gays, bisexuals and transgender) community. Now, sexual acts, including consensual oral sex between heterosexual adults in private are also criminal offences.

The bench, which took 20 months to write the verdict, said it was up to the Parliament to consider deleting or amending Section 377 of the IPC. It noted that Parliament chose not to delete the section earlier this year when it amended provisions relating to rape and other offences against women.

The verdict drew sharp criticism from rights activists who called it "medieval" and "regressive." Additional solicitor general Indira Jaisingh said the Supreme Court had lost a "historic opportunity" to expand constitutional values. Twenty two appeals were filed against the Delhi High Court verdict, including many by religious bodies from all major faiths. The court did not find any merit in the contentions of Naz Foundation and those supporting the High Court judgment that Section 377 was used to harass and blackmail members of the LGBT community. The bench said the High Court overlooked that, a miniscule fraction of the country's population constituted LGBT and less than 200 persons had been prosecuted under Section 377 of IPC in the last 150 years. It therefore said that there was no sound basis for the High Court to declare the section violative of Articles 14 (right to equality), 15 (right to non-discrimination on the ground of religion, caste, race, sex and creed) and 21 (right to life and personal liberty) of the Constitution. It held that Section 377 did not suffer from the "vice of unconstitutionality" as it "merely" identified certain acts as offences and did not criminalize a particular people or identity or orientation. [1]

Section 377 of Indian Penal Code defines Unnatural Offences as "Whoever voluntarily has carnal intercourse against the order of nature with any man, woman or animal, shall be punished with imprisonment for life, or with imprisonment of either description for a term which may extend to ten years, and shall also be liable to fine. Explanation – Penetration is sufficient to constitute the carnal intercourse necessary to the offence described in this section."[2]

As a quick response to the Supreme Court Judgment, the Indian Medical Association, during the 74th Meeting of its Central Council held on 27th December, 2013 at Rajahmundry, Andhra Pradesh, passed the following resolution on homosexuality [3]: -

- Homosexuality is a variant of sexual orientation and is not a disorder
- It is not inherently linked to mental illness.
- On the other hand, criminalization of homosexuality reduces help seeking behaviour for various health conditions that the person may be suffering from e.g. HIV.
- Decriminalization promotes public health interventions and initiatives.

This conflicting Indian legal and medical approach to the word "Gay" which the Oxford Dictionary defines as "especially of a man – homosexual; relating to homosexuals; dated light-hearted and carefree; dated brightly coloured; n. a homosexual person, especially a man; origin old French gai" [4] is a compelling fact and the situation for medicolegal experts to retrospect the origin of the term and its journey to the Indian medical and legal corridors of the day.

Origin of Gay:

The word "gay" seems to have its origins around the 12th century in England, derived from the Old French word 'gai' which in turn was originally derived from a Germanic word, though that is not completely known. The word's original meaning meant something to the effect of "joyful", "carefree", " full of mitrth", or bright and showy". [5]

However, around the early parts of the 17th century, the word began to be associated with immorality. By the mid-17th century, according to an Oxford dictionary definition at the time, the meaning of the word had changed to mean "addicted to pleasures and dissipations. Often euphemistically: Of loose and immoral life". This is an extension of one of the original meanings of "carefree", meaning more or less uninhibited.

Fast-forward to the 19th century and the word gay referred to a woman who was a prostitute and a gay man was someone who slept with a lot of women, often prostitutes. Sort of ironical that today a gay man doesn't sleep with women. Also at this time, the phrase "gay it" meant to have sex.

With these new definitions, the original meanings of "carefree", "joyful", and "bright and showy" were still around; so the word was not exclusively used to refer to prostitutes or a promiscuous man. Those were just accepted definitions, along with other meanings of the word.

Around the 1920s and 1930s, however, the word started to have a new meaning. In terms of the sexual meaning of the word, a "gay man" no longer just meant a man who had sex with a lot of women, but now started to refer to men who had sex with other men. There was also another word "gay cat" at this time which meant a homosexual boy.

By 1955, the word gay now officially acquired the new added definition of meaning homosexual males. Gay men themselves seem to have been behind the driving thrust for this new definition as they felt (and most still do), that "homosexual" is much too clinical sounding and is often thought of as offensive among gay people due to sounding like a disorder. As such, it was common amongst themselves to refer to one another as "gay" decades before this was a commonly known definition (reportedly homosexual men were calling one another gay as early as the 1920s). At this time, homosexual women were referred to as lesbians, not gay. Although women could still be called gay if they were prostitutes as that meaning had not yet 100 % disappeared.

Since then, gay, meaning homosexual male, has steadily driven out all the other definitions that have floated about through time and of course also has gradually begun supplementing the word 'lesbian' as referring to women who are homosexual.

Not satisfied with simply changing its definition once a century, as early as the 1980s a new definition for the word gay started popping up among American youth where now something gay could either mean a homosexual or something that is "lame" or "stupid" or the like. This new definition was originally almost exclusively meant as an insulting term, derogatorily referencing homosexuals. However, according to a report done by the BBC, most children are still using the word to mean "lame", but now with having nothing to do with sexuality of any sort and also not generally meant as an insulting term against homosexuals. Now it is used more to the effect of just saying, for instance, "That movie was gay" as in stupid, but having nothing to do with homosexuality in their minds and not generally directed at people (thus not supposedly meant to be offensive to the gay community). Whereas the origins of this new "lame" or "stupid" definition were most definitely meant to be insulting and were primarily directed at people.

Facts about Homosexuality and Mental Health:-

Historical Background:

Modern attitudes toward homosexuality have religious, legal, and medical underpinnings. Before the High Middle Ages, homosexual acts appear to have been tolerated or ignored by the Christian Church throughout Europe. Beginning in the latter twelfth century, however, hostility toward homosexuality began to take root, and eventually spread throughout European religious and secular institutions. Condemnation of homosexual acts (and other non-procreative sexual behavior) as "unnatural," which received official expression in the writings of Thomas Aquinas and others, became widespread and has continued through the present day [6]

Religious teachings soon were incorporated into legal sanctions. Many of the early American colonies, for example, enacted stiff criminal penalties for sodomy, an umbrella term that encompassed a wide variety of sexual acts that were non-procreative (including homosexual behavior), occurred outside of marriage (e.g., sex between a man and woman who were not married), or violated traditions (e.g., sex between husband and wife with the woman on top). The statutes often described such conduct only in Latin or with oblique phrases such as "wickedness not to be named". In some places, such as the New Haven colony, male and female homosexual acts were punishable by death [7].

By the end of the 19th century, medicine and psychiatry were effectively competing with religion and the law for jurisdiction over sexuality. As a consequence, discourse about homosexuality expanded

from the realms of sin and crime to include that of pathology. This historical shift was generally considered progressive because a sick person was less blameful than a sinner or criminal [8]

Even within medicine and psychiatry, however, homosexuality was not universally viewed as pathology. Richard von Krafft-Ebing described it as a degenerative sickness in his Psychopathia Sexualis, but Sigmund Freud and Havelock Ellis both adopted more accepting stances. Early in the twentieth century Ellis [9] argued that homosexuality was inborn and therefore not immoral, that it was not a disease, and that many homosexuals made outstanding contributions to society [10]

Sigmund Freud: -

Sigmund Freud's basic theory of human sexuality was different from that of Ellis. He believed all human beings were innately bisexual, and that they become heterosexual or homosexual as a result of their experiences with parents and others [11]. Nevertheless, Freud agreed with Ellis that a homosexual orientation should not be viewed as a form of pathology. In a now-famous letter to an American mother in 1935, Freud wrote: "Homosexuality is assuredly no advantage, but it is nothing to be ashamed of, no vice, no degradation, it cannot be classified as an illness; we consider it to be a variation of the sexual function produced by a certain arrest of sexual development. Many highly respectable individuals of ancient and modern times have been homosexuals, several of the greatest men among them (Plato, Michelangelo, Leonardo da Vinci, etc.). It is a great injustice to persecute homosexuality as a crime, and cruelty too..... "If your son is unhappy, neurotic, torn by conflicts, inhibited in his social life, analysis may bring him harmony, peace of mind, full efficiency whether he remains a homosexual or gets changed...." (Reprinted in Jones, 1957, pp. 208-209, from the American Journal of Psychiatry, 1951, 107, 786)

Later psychoanalysts: -

Later psychoanalysts did not follow this view, however. Sandor Rado (1940, 1949) rejected Freud's assumption of inherent bisexuality, arguing instead that heterosexuality is natural and that homosexuality is a "reparative" attempt to achieve sexual pleasure when normal heterosexual outlet proves too threatening. Other analysts later argued that homosexuality resulted from pathological family relationships during the oedipal period (around 4-5 years of age) and claimed that they observed these patterns in their homosexual patients [12] Charles Socarides (1968) speculated that the etiology of homosexuality was pre-oedipal and, therefore even more pathological than had been supposed by earlier analysts.

Biases in Psychoanalysis

Although psychoanalytic theories of homosexuality once had considerable influence in psychiatry and in the larger culture, they were not subjected to rigorous empirical testing. Instead, they were based on analysts' clinical observations of patients already known by them to be homosexual.

This procedure compromises the validity of the psychoanalytic conclusions in at least two important ways. First, the analyst's theoretical orientations, expectations, and personal attitudes are likely to bias her or his observations. To avoid such bias, scientists take great pains in their studies to ensure that the researchers who actually collect the data do not have expectations about how a particular research participant will respond. An example is the "double blind" procedure used in many experiments. Such procedures have not been used in clinical psychoanalytic studies of homosexuality.

A second problem with psychoanalytic studies is that they have only examined homosexuals who were already under psychiatric care – in other words, homosexuals who were seeking treatment or therapy. Patients, however, cannot be assumed to be representative of the general population. Just as it would be inappropriate to draw conclusions about all heterosexuals based only on data from heterosexual psychiatric patients, we cannot generalize from observations of homosexual patients to the entire population of gay men and lesbians

Alfred Kinsey

A more tolerant stance toward homosexuality was adopted by researchers from other disciplines. Zoologist and taxonomist Alfred C. Kinsey, in his groundbreaking empirical studies of sexual behavior among American adults, revealed that a significant number of his research participants reported having engaged in homosexual behavior to the point of orgasm after age 16 [13]. Furthermore, Kinsey and his colleagues reported that 10% of the males in their sample and 2-6% of the females (depending on marital status) had been more or less exclusively homosexual in their behavior for at least three years between the ages of 16 and 55.

Military Research

Although dispassionate scientific research on whether homosexuality should be viewed as an illness was largely absent from the fields of psychiatry, psychology, and medicine during the first half of the twentieth century, some researchers remained unconvinced that all homosexual individuals were mentally ill or socially misfit. Berube (1990) reported the results of previously unpublished studies conducted by military physicians and researchers during World War II. These studies challenged the

equation of homosexuality with psychopathology, as well as the stereotype that homosexual recruits could not be good soldiers. [14]

A common conclusion in their wartime studies was that, in the words of Maj. Carl H. Jonas, who studied fifty-three white and seven black men at Camp Haan, California, "overt homosexuality occurs in a heterogeneous group of individuals." Dr. Clements Fry, director of the Yale University student clinic, and Edna Rostow, a social worker, who together studied the service records of 183 servicemen, discovered that there was no evidence to support the common belief that "homosexuality is uniformly correlated with specific personality traits" and concluded that generalizations about the homosexual personality "are not yet reliable."

.... Sometimes to their amazement, researchers described what they called the "well-adjusted homosexuals" who, in William Menninger's words, "concealed their homosexuality effectively and, at the same time, made creditable records for themselves in the service." Some researchers spoke in glowing terms of these men. "The homosexuals observed in the service," noted Navy doctors Greenspan and Campbell "have been key men in responsible positions whose loss by discharge was acutely felt in their respective departments." They were "conscientious, reliable, well-integrated and abounding in emotional feeling and sincerity." In general, "the homosexual leads a useful productive life, conforming to all dictates of the community, except its sexual requirements" and was "neither a burden nor a detriment to society." Fry and Rostow reported that, based on evidence in service records, homosexuals were no better or worse than other soldiers and that many "performed well in various military jobs" including combat [14]

Today, a large body of published empirical research clearly refutes the notion that homosexuality per se is indicative of or correlated with psychopathology. One of the first and most famous published studies in this area was conducted by psychologist Evelyn Hooker.

Hooker's Study

Hooker's (1957) study was innovative in several important respects. First, rather than simply accepting the predominant view of homosexuality as pathology, she posed the question of whether homosexuals and heterosexuals differed in their psychological adjustment. Second, rather than studying psychiatric patients, she recruited a sample of homosexual men who were functioning normally in society. Third, she employed a procedure that asked experts to rate the adjustment of men without prior knowledge of their sexual orientation. This method addressed an important source of bias that had vitiated so many previous studies of homosexuality.

Hooker concluded from her data that homosexuality is not a clinical entity and that homosexuality is not inherently associated with psychopathology. [15]

Although some investigations published since Hooker's study have claimed to support the view of homosexuality as pathological, they have been methodologically weak. Many used only clinical or incarcerated samples, for example, from which generalizations to the population at large are not possible. Others failed to safeguard the data collection procedures from possible biases by the investigators – for example, a man's psychological functioning would be evaluated by his own psychoanalyst, who was simultaneously treating him for his homosexuality.

Some studies found differences between homosexual and heterosexual respondents, and then assumed that those differences indicated pathology in the homosexuals. For example, heterosexual and homosexual respondents might report different kinds of childhood experiences or family relationships. It would then be assumed that the patterns reported by the homosexuals indicated pathology, even though there were no differences in psychological functioning between the two groups.

The Weight of Evidence:

In a review of published studies comparing homosexual and heterosexual samples on psychological tests, Gonsiorek (1982) found that, although some differences have been observed in test results between homosexuals and heterosexuals, both groups consistently score within the normal range. Gonsiorek concluded that "Homosexuality in and of itself is unrelated to psychological disturbance or maladjustment. Homosexuals as a group are not more psychologically disturbed on account of their homosexuality" [16]

Confronted with overwhelming empirical evidence and changing cultural views of homosexuality, psychiatrists and psychologists radically altered their views, beginning in the 1970s.

Removal from the DSM

In 1973, the weight of empirical data, coupled with changing social norms and the development of a politically active gay community in the United States, led the Board of Directors of the American Psychiatric Association to remove homosexuality from the Diagnostic and Statistical Manual of Mental Disorders (DSM). Some psychiatrists who fiercely opposed their action subsequently circulated a petition

calling for a vote on the issue by the Association's membership. That vote was held in 1974, and the Board's decision was ratified.

Subsequently, a new diagnosis, ego-dystonic homosexuality, was created for the DSM's third edition in 1980. Ego dystonic homosexuality was indicated by: [1] a persistent lack of heterosexual arousal, which the patient experienced as interfering with initiation or maintenance of wanted heterosexual relationships, and [2] persistent distress from a sustained pattern of unwanted homosexual arousal.

This new diagnostic category, however, was criticized by mental health professionals on numerous grounds. It was viewed by many as a political compromise to appease those psychiatrists – mainly psychoanalysts – who still considered homosexuality as pathology. Others questioned the appropriateness of having a separate diagnosis that described the content of an individual's dysphoria. They argued that the psychological problems related to ego-dystonic homosexuality could be treated as well by other general diagnostic categories, and that the existence of the diagnosis perpetuated antigay stigma.

Moreover, widespread prejudice against homosexuality in the United States meant that many people who are homosexual go through an initial phase in which their homosexuality could be considered ego dystonic. According to the American Psychiatric Association, "Fears and misunderstandings about homosexuality are widespread..... and present daunting challenges to the development and maintenance of a positive self-image in gay, lesbian and bisexual persons and often to their families as well."

In 1986, the diagnosis was removed entirely from the DSM. The only vestige of ego dystonic homosexuality in the revised DSM-III occurred under Sexual Disorders Not Otherwise Specified, which included persistent and marked distress about one's sexual orientation [17]. The American Psychological Association (APA) promptly endorsed the psychiatrists' actions, and has since worked intensively to eradicate the stigma historically associated with a homosexual orientation [18].

According to the author of the article “Facts about Homosexuality and Mental Health, the foregoing should not be construed as an argument that sexual minority individuals are free from mental illness and psychological distress. Indeed, given the stresses created by sexual stigma and prejudice, it would be surprising if some of them did not manifest psychological problems [19]. The data from some studies suggest that, although most sexual minority individuals are well adjusted, non-heterosexuals may be at somewhat heightened risk for depression, anxiety, and related problems, compared to exclusive heterosexuals (20]. Unfortunately, because of the way they were originally designed, most of these studies do not yield information about whether and to what extent such risks might be greater for various subgroups within the sexual minority population (e.g., individuals who identify as lesbian, gay, or bisexual versus those who do not; bisexuals versus lesbians and gay men). In future research, it will be important to compare different sexual minority groups in order to understand how so many individuals withstand the stresses imposed by sexual prejudice, and to identify effective strategies for treating those with psychological problems.

Conclusion

a. Since its origin in the 12th century till modern era, the word ‘Gay’ has travelled a long historical journey with challenges on religious, secular, legal, medical and psychological fronts and has undergone all sorts of scrutiny but with inconclusive results and may be a topic of discussion in the times to come due to ever changing mindset of society.
b. Although some psychologists and psychiatrists still hold negative personal attitudes towards homosexuality, but the empirical evidence and professional norms do not support the idea that homosexuality is a form of mental illness or is inherently linked to psychopathology.
c. Seemingly, instead of labeling homosexuality as a sin and crime by one school of thought and pathology by another, it can be better defined as “a habit in the human beings created by and a product of the circumstances leading them away from the natural sexual course prevalent only with the social animal.”
d. It is the stigma and not the criminalization of homosexuality that may reduce help seeking behavior for various health conditions that the person may be suffering from, an apprehension as envisaged by the Indian Medical Association and decriminalization of the homosexuality cannot be linked with promotion of public health interventions and initiatives.
e. There is a scope to amend the Indian law i.e. Section 377 of Indian Penal Code which defines Unnatural Offences with addition of an Exception that “such carnal intercourse can be permitted between two individuals with mutual consent and in private maintaining complete

public decency so that compelling desire of the gay class is fulfilled under the constitutional parameters".

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Original Research Paper

HISTOPATHOLOGICAL FINDINGS IN LIVER IN POISONING CASES - A POSTMORTEM STUDY

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Abstract

In the present study, histopathologic findings were observed in 100 liver specimens of poisoning cases on autopsy. Among 100 cases, 79 were males and 21 females with male to female ratio (3.7: 1). Maximum numbers (34%) of liver specimens received were from 21-30 years of age. Maximum cases (39%) were of aluminium phosphide poisoning. 32% deaths were due to chlorocompound group of insecticides and 27% due to organophosphorus compounds. Various histological findings in liver on autopsy in poisoning cases were congestion, degeneration, mononuclear cell infiltration, fatty change, necrosis, sinusoidal dilatation and haemorrhage.

Keywords: Autopsy, Liver histopathology, Poisons

Introduction

A poison is a substance (liquid, solid or gaseous), which when introduced into the living body or brought into contact with any part thereof, will produce ill health or death by its constitutional or local effects or both.

Histopathology is an important and most useful way to find out the conditions of internal visceral organs and the unique method for diagnosis of liver diseases because the liver is the site of many diseases, of which some become symptomatic while some are diagnosed only on autopsy.[1]

The highest incidence of poisoning was due to household agents (44.1%) followed by drugs (18.8%), agricultural pesticides (12.8%), industrial chemicals (8.9%), animals bites and stings (4.7%), plants (1.7%), unknown (2.9%) and miscellaneous groups (5.6%).[2]

Review of literature

In a study done on 12 cases [3] of poisoning of halogenated hydrocarbons, fatty change was found in 3% of cases and mononuclear cell infiltration in 5% of cases.

Histopathological findings in 116 cases of aluminium phosphide poisoning in liver [4] showed congestion in 100% of cases and fatty change in 7.75% of cases.

In a study of 50 medico legal autopsy [5] cases of aluminium phosphide poisoning showed congested liver in 44 cases (88%), mild fatty change in 19 cases (38%) and areas of hemorrhagic necrosis in 10 cases (20%).

In a study done at Mahatma Gandhi Institute of Medical Sciences, Sewagram, out of 140 autopsies, 78 cases revealed histopathological findings in liver. Out of total 78 (55.71%) cases affecting liver organophosphorous compounds constitute 43 (55.13%) and caused fatty changes in 15 (34.88%); congestion in 20 (46.51%); centrilobular necrosis in 4 (9.30%). Chlorocompound group of insecticides affected liver in 11(14.10%) and revealed fatty changes in 4 (36.36%); congestion in 5 (45.45 %) of cases. [6]

A one year study done from year 1997-1998 showed that most of the poisoning cases were in the age group of 21-30. In poisoning cases, male to female ratio was

found to be 3:1. Various histological findings were fatty change, congestion, sinusoidal dilatation and degeneration. [7]

Tehran Medical College Centre examined histopathological changes of human organs of aluminium phosphide poisoning over 12 month period starting from March 2006. Histopathological changes in liver were central venous congestion, degeneration of hepatocytes and mononuclear infiltration. [8]

Aims

1. To find out the spectrum of poison used for suicide/homicide.
2. To find out the histopathological liver findings in various poisonings.

Materials and Methods

One hundred cases of autopsies of liver of poisoning cases sent by Department of Forensic Medicine, Govt. Medical College Patiala were received in the Department of Pathology, Govt. Medical College Patiala for this study. The required information was collected from the Department of Forensic Medicine, Govt. Medical College, Patiala from 2010-2012. This study included all the age groups.

In the Pathology Department, gross examination of each liver (weight, measurements, colour, shape) was done and cut surface was measured. Multiple tissue pieces from different areas that were normal and abnormal were taken and processed. In most of the cases, routine hematoxylin and eosin stained sections were prepared and studied. However, special stain like Van Gieson was used, wherever required. Necessary information was collected from the Department of Forensic Medicine, Government Medical College, Patiala.

Age	Male	Female	Total	%age
10-20	12	5	17	17
21-30	29	5	34	34
31-40	14	7	21	21
41-50	12	2	14	14
51-60	8	2	10	10
61-70	3	_	3	3
71-80	1	_	1	1
Total	79	21	100	100

Observations

The following observations were recorded in table 1 to 3.

Table 1 showing Age and sex distribution of 100 cases of liver poisoning cases

Table 2 showing distribution of cases according to type of poison

Type of poison	Male	Female	No. of cases
Aluminium phosphide	29	10	39
Chlorocompound group	30	2	32
Organophosphorus group	19	8	27
Diazepam	1	-	1
Acid	-	1	1

Table 3 showing Histological findings in liver in Aluminium phosphide poisoning

Histological findings	No. of cases	% age
Congestion	26	66.6
Degeneration	18	46
Mononuclear cell infiltration	20	51
Fatty change	18	46
Necrosis	5	13
Sinusoidal dilatation	4	10
Haemorrhage	8	20.5

Discussion

The present study is based on the critical analysis of gross and microscopic examination of liver autopsy of 100 poisoning cases showing various lesions.

Poisoning is a global problem. Aluminium phosphide poisoning has become the commonest pesticide in some Indian states. Out of 100 autopsy cases of present study, 79 were males and 21 females. Maximum poisoning cases were in the age group of 21-30 years. Male to female ratio is 3.7: 1 which is matching with male to female ratio that is 3:1 of study that was done by Gargi et al. [7] (Table 4)

Fatty change and congestion (Fig 1 & 2) were the histological findings in liver in Aluminium phosphide poisoning in all the (39) cases. Mehrpour et al [8] studied 45

poisoning cases and reported fatty change in 22% and congestion in 68% of cases. The present study showed fatty change in 20% of cases and congestion in 66.6% of cases. This present study is matching with the study of Mehrpour et al [8] (Table 5). A study done by Shrivastava et al [4] found fatty change in 7.75% and congestion in 100% of cases. Jain et al [5] showed fatty change in 38% and congestion in 88% of cases.

Table 4 showing **c**omparable study- maximum affected age group

Study	Year	Age group
Gargi et al	2006	21-30years
Present study	2012	21-30 years

Table 5 showing comparable study- histopathological findings in liver in ALP poisoning

Study	Year	Fatty change	Congestion
Shrivastava et al	2003	7.75%	100%
Mehrpour et al	2008	22%	68%
Jain et al	2005	38%	88%
The present study	2012	20%	66.6%

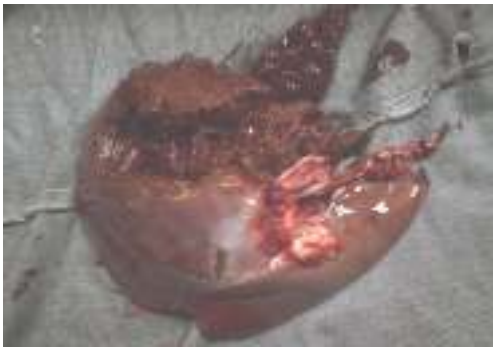

Figure 1 showing Gross of Congested liver

Histological findings in liver in Organochlorous poisoning in present study showed fatty change (34%), congestion (44%) and sinusoidal dilatation (9%) in 32 cases. Guzelian P S [3] showed fatty change in 25% of cases out of 12. Study done by Sutay SS et al [6] on 11 cases of Organochlorous poisoning showed fatty change in 36% of cases, congestion in 45% of cases and sinusoidal dilatation in 9.09% of cases. Study done by Sutay SS et al [6] is matching with the present study.

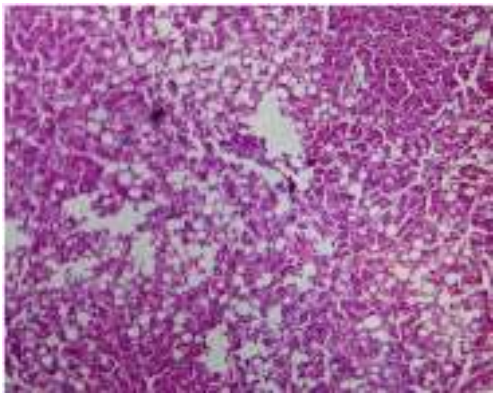

Figure 2 showing Photomicrograph of Liver showing Fatty change (H&E X100)

Table 6 showing comparable study- Histopathological findings in liver in Organochlorous poisoning cases

Study	Year	Fatty change	congestion	Sinusoidal dilatation
Sutay SS et al	2005	36%	45%	9.09%
Guzelian PS	1985	25%	-	-
Present study	2012	34%	44%	9%

Conclusions

1. The present study was a critical analysis of gross and microscopic examination of 100 cases of liver autopsies of poisoning cases of all age groups undertaken to find out the spectrum of poison used for suicide/homicide and to find out the histopathological liver findings in various poisonings.
2. There were 79% of male and 21% of female cases with male to female ratio of 3.7: 1.
3. About 39% cases used aluminium phosphide as poison followed by chlorocompound group of insecticides

(32%), organophosphorus insecticide (27%), diazepam (1%) and acid (1%).

4. Histopathological findings in liver in aluminium phosphide poisoning were congestion (66.6%), degeneration (46%), mononuclear cell infiltration (51%), fatty change (46%), necrosis (13%), sinusoidal dilatation (10%) and hemorrhage (20.5%).
5. Histological findings in liver in organochlorous poisoning were fatty change (34%), congestion (44%) and sinusoidal dilatation (9%).
6. Various histological findings in liver in organophosphorus insecticides were fatty change (33%), congestion (44%), centrilobular necrosis (7%) and sinusoidal dilatation (8%).

Conflict of interest

None Declared.

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Original Research Paper

THERMAL BURN: AN EPIDEMIOLOGICAL RETROSPECTIVE STUDY

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Abstract

The present retrospective study has been conducted in Varanasi area, cases brought to the Department of Forensic Medicine, IMS, BHU, Varanasi for the period of two years i.e. 2009 and 2010. Total unnatural deaths reported during the study period deaths due to burn injuries were 17.98 % and 17.07% respectively, showing the more or less steady trend. Female burn deaths dominated over male in the ratio of 1:4. Most of the deceased were from the married group (73.19%) followed by unmarried (23.55%). Predominant age group found to be 21-30 years (45.13%) followed by age group 11-20 and 31-40 years showing almost same rate around 20% reflecting that young adults were more involved in such type of deaths. As regards to place of death only 9.72% died on the spot or on the way to Hospital while 90.28% died in Hospital reflecting the prompt and proper health care services.

Keywords: Dowry death; Female burn; Magistrate; Cr.P.C;

Introduction

Fire was perhaps man's first double-edged sword, evidenced throughout history, it has served as well as destroyed mankind [1].Burning or burn injuries are caused due to contact with dry heat. Thus burning may occur due to contact with hot metal or any other hot solid or it may be caused due to contact with flame. The effect of contact very extremely depending on the degree of heat and period of exposure [2]. Burn deaths have tremendous medico-legal importance as they may be considered to be the commonest cause of unnatural deaths in India. Often, the circumstances of burns are enveloped in mystery, obscurity and unreliable statements. The reason behind this action may be personal, domestic, occupational or social tragedy and more recently dowry deaths [3].

Married female burn death where death of female occurs within 7 years of her marriage such death cases investigated by Magistrate under Cr.P.C 176(Dowry death) and other burn deaths as routinely investigated by police as per section 174 of Cr.P.C. In India all newly married female burn deaths are linked with Dowry death, where a young married women commits suicide in consequent to their being subjected to cruelty or harassment by their husband or in-laws or his relative constitute the offence of Dowry death, a monstrous social evil is widely prevalent and deep rooted in society inspite of stringent Legal system and administration. A burn injuries death is very painful but what compels or in what circumstances women or men commits suicide or those accidentally burned but most heinous is burning of newly married women i.e. homicidal burning. In this respect it is very difficult or next to impossible to find out the manner (Suicidal, Accidental and Homicidal) of burn injuries that in what circumstances the burn injuries took place it

can only be possible up to some extent by meticulous investigation of scene of crime and interrogation of person concerned. In most of the cases of female burn deaths as per interrogation of her parents are homicidal in manner i.e. their daughter was alleged to be killed by burning by in-laws and their relative but at the same time as per in-laws she committed suicide or burned accidently while cooking, in very few cases both the sides are agreed on the same theory.

Material and Method

This retrospective study was carried out on the burn death cases brought to the Department of Forensic Medicine, Institute of Medical Sciences, Banaras Hindu University, from Varanasi itself and nearby districts and western part of Bihar for medico-legal autopsy examination.

Data was collected from postmortem record register for the period from 1st January 2009 to 31st December 2010. During this period total of 706 burn deaths cases were recorded out of 4031 medico-legal postmortem conducted. Data was analyzed retrospectively in respect of incidence of burn deaths, age, sex, cause of death, place of death and other relevant data.

Results and Observation

Out of 4031 medico-legal autopsy cases conducted during the study period from 1st January 2009 to 31st December 2010, total of 706 cases (17.51%) of death from fatal burn injuries were recorded. If we split the finding year wise 357 cases (17.98%) and 349 Cases (17.07%) in year 2009 and 2010 respectively (Table-1), which is almost static. Male comprised of 20.25% of total burn death. Female (79.75%) preponderance was seen in burning with male female ratio equal to 1:4 (Table 2 & Table 6). Maximum of the victims of burn deaths were in the age group 21-30 year followed by 31-40 years in the year 2009 but 11-20 age group in the year 2010 with slight difference (Table 3 & 7). Most of the victims of burn deaths were recorded between 21-40 year (which is more than half of the total burn death) with peak incidence at 21-30 year (Table 3 & 7). Extremes of ages are least involved as compared to adult age group as seen in tables for age and sex incidence.

If we consider Season wise distribution of burn victims maximum death were reported in summer season in 2009 (43.98%) and 2010(47.27%) irrespective of sex followed by winter in the year 2009 and equal incidence in year 2010 (Table 2 & 6). Married person (68.63%) in year 2009 and (77.75%) in 2010 outnumbered the unmarried(27.73%) in 2009 and (19.36%) in 2010 (and widow and widower Table4 &8).Regarding cause of death most of the victims died of septicaemia followed by primary shock (including spot deaths or death on the way to hospital and hospital death within 48 hours of burn infliction) (Table5 &9).

Discussion

Human society ever since its inception has never been free from criminal activity. Burn injuries occur worldwide in all society irrespective of its developed, developing or poorly developed condition. These injuries constitute a medical and psychological problem but also have severe economic and social consequences not only to the victim but also to their family and society in general [4].

Analysis of sex and age record in our study showed that females (77.59%) in 2009 & (81.95%) in 2010 superseded males with percentage of 22.41 and 18.05 in 2009 and 2010 respectively. The overall female preponderance in the present study confirms with some previous study [5, 6, 7, 8, 9]. Married females 563 (79.75%) most common victim of present study followed by married male 143 (20.25%) which is consistent with the study of Ghaffar et al. [5, 9]. In this study most of the patients have died due to septicemia in both the years 59.94% and 55.49% (Table-5 & 9) and is consistent with study done by Singh et al [10] .This shows the prompt and proper health services provided to people suffering from burn injuries. In the present study most of the victim were died in Summer season followed by winter and rainy

Conflict of interest

None declared

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Table1: Incidence of burn deaths in Medico-legal autopsy

Year	Total cases	Thermal Burn Death	%
2009	1986	357	17.98
2010	2045	349	17.07
Total	4031	706	

Table2: Season wise incidence of Thermal burn death in year (2009)

Season	Male	Female	Total	%
Summer	46	111	157	43.98
Rainy	12	75	87	24.37
Winter	22	91	113	31.65
Total	80(22.41 %)	277(77.59 %)	357	100

Table 3: Age and Sex wise incidence of burn death in year (2009)

Age in years	Male	Female	Total (%)
0-10	5	6	11(3.08%)
11-20	16	54	70(19.61%)
21-30	23	130	153(42.86%)
31-40	20	56	76(21.29%)
41-50	6	15	21(5.89%)
51-60	4	5	9(2.52%)
61-70	5	8	13(3.64%)
71-above	1	3	4(1.12%)

Table 4: Marital status of burn death cases in year (2009)

Marital Status	Male	Female	Total (%)
Married	48	197	245(68.63 %)
Unmarried	27	72	99(27.73%)
Widow/Widower	5	8	13(3.64%)
Total	80	277	357(100%)

Table 5: Cause of death of burn death cases in year (2009)

Cause of death	Male	Female	Total (%)
Primary shock	32	111	143(40.06%)
Septicaemic Shock	48	166	214(59.94%)
Total	80	277	357(100%)

Table 6: Season wise incidence of burn death in Year (2010)

Season	Male	Female	Total(%)
Summer	32	135	167(47.27%)
Rainy	15	76	91(26.30%)
Winter	16	75	91(26.30%)
Total	63(18.05%)	286(81.95%)	349(100%)

Table 7: Age and sex wise incidence of burn death cases in year (2010)

Age in years	Male	Female	Total (%)
0-10	5	4	9(2.60%)
11-20	13	60	73(21.10%)
21-30	19	145	164(47.40%)
31-40	13	49	62(17.92%)
41-50	6	12	18(5.20%)
51-60	3	7	10(2.89%)
61-70	4	3	7(2.02%)
71-Above	Nil	3	3(0.87%)
Total	63	286	349(100%)

Table 8: Cause of Death in burn death cases in year (2010)

Cause of death	Male	Female	Total (%)
Primary Shock	30	127	157(44.5%)
Septicaemic Shock	33	159	192(55.49%)
Total	63	286	349(100%)

Table 9: Marital status of burn death victims in year (2010)

Marital status	Male	Female	Total (%)
Married	40	230	270(77.75%)
Unmarried	21	48	69(19.36%)
Widow/Widower	2	8	10(2.89%)
Total	63	286	349(100%)

Table 10: Cause of Death in burn victims in year (2009)

Cause of death	Male	Female	Total	%
Primary Shock	32	111	143	40.06
Septicaemic Shock	48	166	214	59.94
Total	80	277	357	100

Table-11: Cause of death in burn victims in year (2010)

Cause of death	Male	Female	Total (%)
Primary Shock	30	124	154(44.13)
Septicemia Shock	33	162	195(55.87)
Total	63	286	349(100)

Original Research Article

POISONING TRENDS AT A TERTIARY HOSPITAL: A RETROSPECTIVE ANALYSIS

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Abstract

Poison is defined as any substance which when administered in living body through any route (Inhalation, Ingestion, surface or absorption) will produce ill-health or death by its action which is due to its physical chemical or physiological properties. Management at the emergency department is of utmost importance in all cases of poisoning. The social, economical and regional landscape differs from place to place, thus an in hospital protocol for management of alleged cases of poisoning are essential. Punjab being an agrarian society with its major share of population working in fields has access to the large number of pesticides, herbicides and weedicides. The above factor when compounded by financial straits and high level of addictions make them prone to be a victim of poisoning, both suicidal and homicidal. Seventy one cases of alleged intake of poisonous substances were reported at Emergency Department of Rajindra Hospital/ Government Medical College, Patiala. Diagnosis of the specific poisoning was made using clinical features and poison containers obtained from the scene. The major poisoning included 20 cases (28.16%) of aluminium phosphide, 18 (25.35%) cases of organophosphorus (OP) poisoning, 10 (14.08%) cases of zinc phosphide poisoning, 8 (11.26%) cases of organochlorine poisoning. In hospital mortality rate was 9.85%.

Keywords: Poisoning, Aluminium phosphide, Zinc phosphide

Introduction

Poison is defined as any substance which when administered in living body through any route (Inhalation, Ingestion, surface or absorption) will produce ill-health or death by its action which is due to its physical chemical or physiological proper ties. [1] Management at the emergency department is of utmost importance in all cases of poisoning. The social, economical and regional landscape differs from place to place, thus an in hospital protocol for management of alleged cases of poisoning is essential. Punjab being an agrarian society with its major share of population working in fields has access to the large number of pesticides, herbicides and weedicides. The above factor

when compounded by financial straits and high level of addictions make them prone to be a victim of poisoning, both suicidal and homicidal.

Pesticide poisoning, whether due to self, accidental, occupational or for homicidal purpose, is a global public health problem. [2] Each year around three lakh deaths occur worldwide due to pesticide poisoning. [3] Aluminium phosphide poisoning is being used as a common outdoor and indoor pesticide in developing countries as it is cheap, effective, and free from toxic residue and does not affect seed viability. [4]

First available report of aluminium phosphide poisoning was from India in early 1980s and has grown to the proportion of being the most common poisoning reported. (5 – 8] Commercially, it is available as dark grey tablets of 3.0 g each, consisting of aluminium phosphide (56%) and carbamate (44%), in the names of Celphos, Alphos, Quickphos, Phosfume, Phostoxin, Synfume or Chemfume.[9, 10]

Organophosphate (OP) poisoning is common in our country and occurs mostly by voluntary ingestion, inhalation, or by absorption through the skin. The clinical presentations and outcome of OP poisoning depend not only on the pesticide but also on the dose, the route of administration, and delay in treatment.

Methodology

This retrospective analysis was conducted in Rajindra Hospital/ Government Medical College, Patiala between 1st July 2013 and 31st December 2013. 71 cases of alleged poisoning were reported. The culprit poison was identified using clinical features and poison container brought along with the patients. Demographic, epidemiological and clinical features were obtained, analyzed and interpreted.

Observations

To the well-organized mind, death is but the next great adventure and to the addicted and ignorant it's an escape route. Among the seventy one subjects included in the assessment, 39 (54.52%) were male and 32 (45.07%) were female. The most common age group was 30 – 50 years of age. Mean age was 48.67±6.23 years in male and 42.71±5.74 years in female. More than two third of the study group belonged to low socio-economic strata. 33 males had atleast one form of addiction, the most common being alcoholism. 23 subjects had more than one form of addiction. 56 (78.87%) had financial or inter personal difficulties, in form of single parent or marital asynchrony.

Addiction	Frequency
Alcohol	27
Opioid derivatives	16
Tobacco	23
Others	9

The major agents involved included 20 cases (28.16%) of aluminium phosphide, 18 (25.35%) cases of organophosphorus (OP) poisoning, 10 (14.08%) cases of zinc phosphide poisoning, 8 (11.26%) cases of organochlorine poisoning. Other less common causes include benzodiazepine, permethrin, imidacloprid, cartap and phenol poisoning. In 4 cases the substance responsible couldn't be identified.

Substance	Frequency (%)
Aluminium phosphide	20 (28.16%)
Organophosphorus	18 (25.35%)
Organochlorine	08 (11.26%)
Zinc phosphide	10 (14.08%)
Benzodiazepine	04 (05.63%)
Imidacloprid	03 (04.22%)
Cartap hydrochloride	02 (02.81%)
Unrecognized	04 (05.63%)

The most common mode of poisoning was suicidal 49 (69.01%), followed by accidental 22 (30.98%). The route of exposure was mainly oral 61 (85.91%), dermal 5 (07.04%), and inhalation 5 (07.04%).

Discussion

World Health Organization (WHO) estimated 0.3 million people die every year due to various poisoning agents. [12] Acute pesticide poisoning is one of the most common causes of intentional deaths worldwide. [13] Majority of pesticide exposure is seen more in middle and low income countries due to increased use of agrochemicals in agricultural sector. [14]

As observed in contemporary literature suicidal attempts and aluminium phosphide poisoning leads the pack in their respective domains.[15] The most common age group involved was 30 – 50 years of age, reflecting the deep penetration of addiction and mental ill health in the productive age group of the community. Involvement of this productive age group not only poses serious hazard to the national growth but imparts setback among the next generation whose development and learning period be plagued by insecurity.

Conclusion

Poisoning is a preventable ally of morbidity and mortality. Rather than treating the poisoned subjects efforts should be put forth to cut down addiction, increase access to mental health facilities with counseling centers in rural areas. Prompt identification of the culprit chemical should be the first priority, apt and earliest treatment of the same can decrease the mortality and morbidity.

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Original Research Article

USE OF MAGGOTS FOR THE ESTIMATION OF TIME SINCE DEATH

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Abstract

The time since death is an important parameter in post-mortem examination .Maggots are when present on the dead body should be used to calculate the time since death. The various species of the flies such as houseflies and blowflies lay their eggs on the natural orifices and the wounds. The eggs hatch in the maggots .The stages of the maggot's development are called as instars. The time since death calculated from the other changes in the dead body after the death compared with the development stages of maggots to know the exact time since death. In the present study 38 dead bodies are studied which were infested by the maggots. The maggot's infestation is effected by the clothing, the season, temperature and relative humidity. The collected data was statistically analyzed by using SPSS version 20. The time since death from the eggs of the flies is 1-3days, from maggots is 2-7days and from empty pupa is about one month. Males (92%) outnumbered females (8%). According to the stages of decomposition, maximum number of cases were in the decaying stage. Hatching was delayed in autumn and in winter.

Keywords:

Keywords: Time since death, maggots, insects, blowflies and houseflies

Introduction

Flies of various species such as houseflies and blowflies are attracted towards the dead body to lay their eggs in the open wounds and natural orifices. The eggs hatch in to maggots or larvae with in the eight to twenty hours during hot weather. The maggots crawl in to the interior of the body and destroy the soft tissue the maggots becomes in to pupae in four to five days through developing stages known as instars as described by Mathiharan and Patnaik.[1]

The carrion insects are grouped by Lord and Rodrigue in to:

Necrophagous species: These species feed on corpse tissue and further subdivided in to (a)Sarcosaprophages: Calliphoridae, Sarcophagidae, Muscidae and Dermestidae. (b)Coprophages: Scarabaeidae and Muscidae. (c)Dermatophages: Dermestidae and Tineidae.

Necrophages- Predaceous Species: Ants ,beetles and blow fly larvae.

Predaceous Species:Histeridae and Staphylinidae.

Parasitic Species:Wasps.

Adventive or Incidental Species: Spiders, Centipedes, millipedes and mites etc.[2]

Aggarwal et al studied the size of the maggots is also useful in estimating the time since death. The 5mm maggot indicates post-mortem interval of 1to2days, 10mm size indicates the post-mortem interval of 2to3days and 20mm size indicates the time since death is 3to7days.[3]

Species identification from the maggots on gross examination is difficult. There is extreme similarity in the species of C.rufufacies and C.megacephala even on the scanning electron microscope as found by Sukontason et al.[4] DNA is becoming useful for species identification. Other applications include identification of insect gut contents and the characterization of the population genetic structure of forensically important species. Highly skilled technical expert is required to carry out these procedures as described by Wells and Stevens.[5]

Shiao and Yeh found that the C.rufifacies larvae eat the larvae of other species and of same species as food. This will lead to change in duration of larval stages. The largest reduction in the larval duration is approximately 25 hours for C.megacephala and 34 hours in C.rufifacies. So this will affect the calculation of post-mortem interval from the maggots.[6] Chen et al detected that the housefly Musca domestica can also found in the decomposed bodies at the dry stage of the decomposition.[7] The weapon can also be identified by the flies. Case of identification of the accused made from his sickle. The investigator told all the suspects to lay down their sickles on the floor. Invisible traces of blood drew blowflies to a single sickle of the accused as desribed by Benecke.[8] Sukontason et al found that the maggot specimens found in the corpses are most commonly of blowfly family Calliphoridae. Chrysomya megacephala and C.rufifacies are the most common species found in ecological varied in death scene habitats associated with both urban and forested areas.[9]

Material and Methods

The material for the study includes 38 cases of human corpses having evidence in form of eggs, maggots and pupae etc. which were brought to the mortuary of Forensic medicine and Toxicology, Maharishi Markandeswar Institute Of Medical Sciences And Research Mullana, Haryana from November 2011 to August 2013. The study tools were: Detailed proforma (FORENSIC ENTOMOLOGY DATA FORM-Demographic information including age, sex, date, case number, police station, last seen alive, date and time found, date reported missing, time removed from scene and site description was recorded. Other important particulars like scene of death area-rural / urban / aquatic/ exposure of body were recorded in detail. Scene temperature, stage of decomposition, evidence of scavengers, number of preserved samples, number of live samples, possible traumatic injury sites were also recorded with extreme caution to strengthen the data), Circumstantial evidence of the deceased from the police inquest papers and from the relatives and other persons accompanying the dead body, Post-mortem examination findings and Insect evidence. The collected data was entered in Microsoft Excel. Coding of the variables was done. Data was statistically analysed by using SPSS version 20 and/or Epi-Info version 6 software's.

Observations and results

The maximum number of cases were males between age group 31-40 years with 12 cases and minimum 1 case in age group >61 years as shown in table no 1.

According to stage of decomposition 23 (60.5%) cases showed active decaying, 14 (36.8%) cases showed bloating and 1(2.6%) case was in dry stage (skeletonization) as shown in table in No2.

Table no 3 showing egg stages were maximum in summer. The early larval stage is also seen maximum in summer and minimum in autumn. Similarly the late larval stages, the maximum number were in summer and

minimum in autumn. Late larval stages & pupa were seen maximum in summer and minimum in rainy season. Beetles and pupa were seen in summer, autumn and in spring. Beetles and late larval stage was only seen in summer. Pupa were also seen in summer. Only one case beetles and shell was seen in rainy season.

Table No 4 showing cause of death with different season. Maximum numbers of cases were seen in summer and minimum numbers of cases were seen in spring. Among all the 38 cases the most commonly found oldest stage was the late larval stage in 13(34.2%) cases and the least found oldest stage were the beetles as shown in table no 5.

Discussion

The maggots have a life when they eat the dead bodies. They help in estimating the time since death when seen in large numbers over the dead bodies, the time since death is 2 to7days.

The fresh stage begins at the moment of death and continues until bloating is first evident. This stage includes the immediate changes and early changes following death. The eggs were usually found laid in the natural body openings, folds of the body, hairy regions and especially in the injuries. The bloated stage commences with the onset of corpse swelling and ends when corpse deflates and usually lasts up to a week after death. Discoloration and odour of decay becomes noticeable. Mostly maggots were seen in this stage only. The beginning of decay stage is marked by release of gases, corpse deflates and strong odour is present. In the later part of this stage the colliquative putrefaction of organs begins and the odour of decay becomes strong. All stages of insects are seen. The dry stage is the final stage of decomposition were only dry skin, cartilage and Bones are found. Empty fly puparia were found scattered under and around the corpses. The earliest deposition of eggs by the flies was found to be at 14 hours after death, Where as in autumn it was found to be 18hrs and in spring it was 20hrs

Conflict of Interest

None Declared

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Table No.1 Age Group & Sex wise distribution of study subjects

AGE	SEX		Total
	MALE	FEMALE	
<10	0	1	1
11-20	3	0	3
21-30	8	0	8
31-40	12	1	13
41-50	7	1	8
51-60	4	0	4
>61	1	0	1
Total	35	3	38

Table No.2 Distribution of study subjects according to their decomposition stage

Decomposition stage	FREQUENCY	PERCENT (%)
Decaying	23	60.5
Bloating	14	36.8
Dry/Skeletanization	1	2.6
Total	38	100.0

Table No.3 cross tabulation of old stage with different seasons

	Crosstabulation	SEASON					Total
		Winter	Summer	Rainy	Autumn	Spring	
OLD STAGE	**Egg**	0	2	1	1	1	5
	Maggots (Early larval stage)	2	5	2	1	0	10
	Maggots (Late larval stage)	2	8	2	1	0	13
	Maggots (Late larval stage) & pupa	0	2	1	0	0	3
	Beetles & pupa	0	1	0	1	1	3
	Beetles & late larval stage	0	1	0	0	0	1
	Pupa	0	2	0	0	0	2
	Beetles & shell	0	0	1	0	0	1
	Total	4	21	7	4	2	38

Chart No1 showing

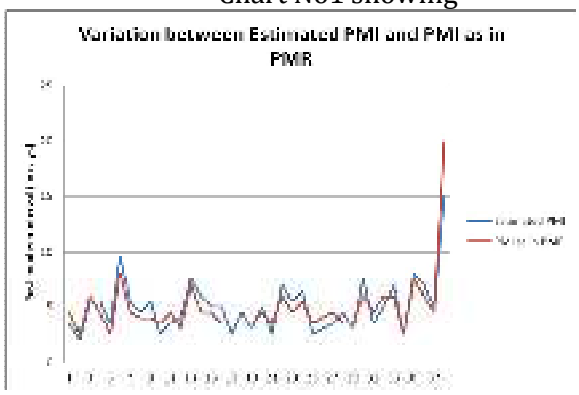

Table 4 showing the cause of death with different season cross tabulation

Cross tabulation		SEASON					Total
		Winter	Summer	Rainy	Autumn	Spring	
Cause Of Death	Drowning	1	10	3	1	1	16
	Hanging	0	3	0	0	0	3
	Poisoning	2	4	0	0	0	6
	Haemorrhage & shock	0	2	1	1	1	5
	Strangulation	1	1	1	0	0	3
	Natural	0	1	2	2	0	5
Total		4	21	7	4	2	38

Table 5 showing the old stage

OLDSTAGE	FREQUENCY	PERCENT (%)
Egg	5	13.2
Early larval stage	10	26.3
Late larval stage	13	34.2
Late larval stage & pupa	3	7.9
Beetles & pupa	3	7.9
Beetles & late larval stage	1	2.6
Pupa	2	5.3
Beetles & shell	1	2.6
Total	38	100.0

Table 6 showing decomposition stages of a corpse

Stage	Features	PMI	Insect stages
Fresh	Immediate & early signs, no odour	1-3 days	Eggs
Bloating	Swelling, bloating, leaking fluids, odour	2-7 days	Maggots (Larval stages)
Decaying	Strong odour, colliquative putrefaction	1-3 weeks	All stages
Dry	Dry skin, cartilage, bones	Around one month	Empty Puparia and Beetles

Case Report

SCARS – DO TELL TALES.

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Abstract

Ritual practices are followed worldwide by different religious groups. Some of these practices include scarring by inflicting incisional cuts on the skin surface, female circumcision during childhood, igniting camphor on palms for worshiping the God, and throwing children off a tall building with a belief that it improves health etc. We present an autopsy case, where a scar was resulted due to branding practices which is still prevailing in rural part of Southern India as a method of curing respiratory illness. The main objective of this case is to focus the autopsy surgeon, that the scars play a phenomenal role in the identification of race, cultural practices and individuality of the person, especially in unknown, decomposed individuals.

Keywords: Scars, identification, ritual practices, branding

Introduction

Ritual practices are followed worldwide by different religious groups. Some of these practices include scarring by inflicting incisional cuts on the skin surface, female circumcision during childhood, igniting camphor on palms for worshiping the God, and throwing children off a tall building with a belief that it improves health etc. **[1-4]** Ritual practices are followed for reasons such as creation of a lifelong bond with others, a sign of respect for elders, a symbol of status or courage, mysticism or magic, protection against evil spirits, and physical or emotional healing **[5].**

Case History

We come across a case, where a female aged 28 years from a village of Southern India, Hindu by religion, committed suicide by consuming an insecticide. During postmortem examination, a scar measuring 5 x 4 x 0.5 cm was present over the front of chest in the midline overlying the manubrium sterni (Fig.1). The scar was quadrangular in shape, elevated with well demarcated margins, firm in consistency having brownish-glistening irregular surface. Her parents revealed that the scar was present since her childhood. On further enquire into the case, it was found that at the age of six months, she was suffering from high fever with repeated bouts of cough, for which, branding was done on the front of chest by a rural quack with a hot flat iron rod. With healing, a scar was formed that was small in size initially and gradually increased to the present size with the age.

Discussion

Ritual practices are mainly based on superstitious beliefs of people. In rural parts of India, it is still a common practice to treat

patients with bizarre type of practice by rural quacks.

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Fig. 1 showing Hypertrophic scar on the front of chest overlying the sternum

Branding is usually done to sick children to cure them of diseases like septicaemia, hernia, tumours, malaria, jaundice and any unexplainable abdomen pain. The common sites of branding are abdomen around the umbilicus, abdominal flanks, base of the penis, and front of the chest. The reason for such ritual practices appears to be the initial pain inflicted during the process of branding makes the sick child awake from the state of weakness or semi-consciousness, thus registering a false belief that the sick child is cured. Branding results in a third degree burn, which forms a design of scar tissue on healing. A derailment in the normal wound-healing process results in fibrous tissue outgrowths, a keloid or hypertrophic scar **[6].**

Religion, spirituality, health and medicine have common roots in the conceptual framework of relationship amongst human beings, nature and God. In medical practice, faith is an essential factor. Also, emotional and spiritual needs of the people play a significant role in finding hope, strength and satisfaction **[7].** These bizarre types of rituals are practiced rampantly in many underdeveloped and developing countries. It is important to educate the public regarding the after effects of such unhealthy practices. The rural public should be given basic education regarding the signs of common diseases, its means of precaution and methodical treatment by skilled medical professionals rather than landing up with untrained quacks.

This short article is presented keeping in corner of mind the possible bright chances of partial identification of missing or unknown individuals in terms of individuality, race and ritual practice in a particular religion.

Conflict of Interest

None Declared.

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Case Report

THRESHER MACHINE ACCIDENT: INJURY RESEMBLING 'CUT-THROAT'

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Abstract

Agriculture holds a very important place in India. The modernization of the agricultural practices led to the increased usage of machines and the accidents caused by them. We report a case of a middle aged man who got entangled in the belt of a thresher machine used in agricultural farm fields but a wound over his neck resembled cut throat injury. The cut throat wound of the neck is usually associated with homicide or suicide with a sharp edged weapon, so a suspicion of foul play was raised. On careful examination with a magnifying glass, it was noted that the injury was a lacerated wound, only muscle deep and had not caused damage to any internal structures of neck. On the basis of naked eye examination this neck wound could easily have been misinterpreted as a homicidal injury.

Keywords: Cut Throat, Agriculture, Thresher.

Introduction

Agriculture holds a very important place in India. In year 2011-12, it contributed 14% in the Gross domestic Product of the country and was the source of livelihood for 50% of Indian population **[1]**. The modern agriculture practices have machinery dominating the hand based techniques in the farms. The use of machines has drastically helped by cutting the time factor, reduction in the need of manual labour, and thereby increasing the production. But with every good comes an associated evil. The increased use of machines led to increased accidents. We report a case of a middle aged man who got entangled in the belt of a tractor thresher machine used in agricultural farm fields.

Sometimes such injuries are found during the autopsy which are not consistent with the history and cause confusion regarding the manner. For example, Cut-throat wounds, which are typically associated with homicide and suicide by sharp edged objects, when found in accidental cases raise a suspicion about the manner. Then the experience and expertise of the doctor comes into play so as to carefully analyze them and thus prevent any misdiagnosis of the case.

Case History

The deceased case was injured while working at his farm fields using a tractor thresher for the mustard plants when his shirt got entangled in the belt of the machine. He was initially admitted in Meerut Medical college hospital then referred to Safdarjung Hospital where he died three days later during treatment.

Autopsy Findings

External General Examination

The dead body was of an average built adult male with no clothes over the body. Surgical bandages present over the chest and right upper limb. The eyes, conjunctivae and

other natural orifices were normal. Inter-costal drainage sites were present over both sides of lower part of chest. Hypostasis was present over the back of body except pressure areas. Rigor Mortis was developed all over the body. No decomposition changes were present over the body.

External Injuries

1) A Sutured wound was present over the middle of front of neck, situated 4.5 cm below the chin. On opening the stitches, lacerated wound of size 12 cm X 2.5 cm, muscle deep was present horizontally placed with partially healed margins.
2) Lacerated wound of size 27 cm X 21 cm, bone deep was present over the front of chest extending from 3 cm inner to left nipple, extending to and involving the upper part of right arm and shoulder, leading to degloving injury of the involved area. The underlying muscles, vessels and nerves were crushed and lacerated, and exposing the ribs which showed multiple fractures. The right arm was deformed with compound fracture of right humerus at its upper one third with the fractured bone ends showing blood extravasations. The lower margin of the wound had a horizontally placed brownish contused abrasion of size 20 cm X 7 cm.
3) Reddish brown abrasion of size 4 cm X 2 cm was present obliquely over the front of neck between injury no. 1 and injury no. 2.
4) Lacerated wounds were present over the middle of forehead and right side of forehead.
5) Sutured lacerated wounds were also present on the right side of chin.
6) Reddish brown abrasions were present over front of right wrist, outer aspect of middle of right arm, left hand, right forearm and right hand.

Internal examination

The neck structures were normal. No evidence of fracture to hyoid bone or other laryngeal cartilage present. All the vessels of the neck, trachea and oesophagus were intact. Fracture of cervical C3, C6-C7 and thoracic D1 vertebrae present with contusion of underlying spinal cord. Blood extravasation was present in the surrounding tissues.

Multiple fractures of rib cage were present on both sides and fractured bone ends show blood extravasation in the adjoining muscles and tissues. Sternum and collar bone were normal. Pleural Cavity was containing about 1000 ml of blood on the right side. Right lung was ruptured at middle lobe with multiple lacerations. Left lung was pale and contused at places. The heart and coronaries were normal.

Stomach contained about 50 ml brownish fluid with no specific smell and walls were normal. Spleen and Kidneys were pale. The Peritoneum, peritoneal Cavity, intestines, pelvic cavity, pelvic bones, bladder and genitals were normal. Extravasation of blood present over the right frontal region of scalp. No fracture of skull was present. Brain was oedematous.

Discussion

The cut-throat wounds by knife or sharp cutting weapon most commonly have clean cut edges. They are associated with the cutting of trachea, Carotids arteries, jugular veins and other neck structures. In homicidal cases the wounds are deeper extending till the vertebra due to excessive use of force by the assailant. The suicidal wounds are accompanied by the hesitation cuts which are superficial and adjoining the fatal wound but not so in homicidal cases. Defence wounds are present in the homicidal cases instead of hesitation cuts [2-5].

The naked eye examination of neck wound (injury no 1) (Photograph 1, 2, 3) gave the impression of a cut-throat injury and raised the suspicion of a foul play. The person had a history of getting entangled in the belt of the thresher machine and the chest injury (injury no 2) (Photograph 1, 2) supported the history. The neck wound edges, depth and the surrounding area were examined by a magnifying glass and it was observed that it is a lacerated wound and not a cut-throat injury as initially suspected. The belt of the machine caused stretching of the skin on the chest leading to degloving injury and the same force produced the neck injury, evident from the continuous abraded area (injury no 3) between neck injury and the chest injury.

India is a country with large agricultural dependence. Despite of this the

safety precautions taken are very minimal leading to a significant amount of morbidity and mortality. The main reason for this is that the farming is an unorganized sector in our country mostly controlled and managed at family level. Agricultural machine accidents are a common menace in India. A study was conducted by ICAR [6] for the period of 2004-2007 reported that out of the total agricultural accidents 30.5% are caused due to farm machines. In farm machines, 31% were due to tractor and tractor operated equipments and 14% were caused due to threshers. Selvan [7] and Tiwari [8] also found higher number of accidents in relation to the usage of tractors and threshers. The fact that the deceased operated a tractor, thresher, machine increased the probability of the accident.

Photograph 1: Neck and Degloving chest Injury

Photograph 2: Neck and Degloving chest injury

Conclusion

The autopsy surgeon sh
haste while interpreting
particularly when the aberrar
found not consistent with th
should carefully examine such
reaching to any conclusion, so as to prevent a wrong opinion in a medicolegal case. By reporting this case we also aim to bring to the notice of the budding forensic experts that such type of neck injury can be caused due to by the body getting entangled in the belts of the motors.

The safety guidelines should be formulated for various machines used in the agriculture, both in the production and the operation. The persons working, operating or assisting in these machines should be given a basic training and education regarding the safety precautions, operating guidelines etc.

Photograph 3: Neck Injury

Conflict of interests: Nil

Reference

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Case Report

DELAYED CAUSES OF DEATH IN HANGING: AN AUTOPSY STUDY

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Abstract

Hanging is one of the most common methods of suicide in India in which death of the individual occurs almost immediately. It is a widely practiced suicidal method in all cultures and has a very effective killing potential with a mortality of 80 percent. Death in hanging occurs immediately, however, a few cases have been reported in literature in which death has occurred after a certain period of time or the patient has survived after prolonged resuscitative measures. We report those cases of delayed death in hanging, for its rarity, for the discussion of the possible delayed causes of death in case of hanging and to emphasize the complications associated with delayed hanging. Present study is conducted on all cases of hanging deaths brought to mortuary of RRMC & hospital, Bangalore for postmortem examination from Jan 2013 to June 2013. The present study is conducted to analyze the cause of death in immediate & delayed cases of hanging.

ords: Hanging, asphyxia, delayed deaths, halopathy, pulmonary edema.

Introduction

Hanging is a form of asphyxia death due to constriction of the air passage at the neck, as a result of suspension of the body by a ligature in the form of a noose, applied in such a manner, when weight of the body acts as a constricting force(1). Weight of the head (5kg-6kg) is enough to act as constricting force. Hanging is one of the commonest methods of suicide especially amongst the Asian countries. The incidence of hanging in India is approximately 25% of total cases of suicide. Hanging is known as a painless mode of death with a very narrow failure rate. Hanging is seen at all age groups. Hanging is always suicidal in nature until proved otherwise. Hanging usually ends in death, and about 80% of victims are found dead at the scene of the hanging. However, sometimes the hanging victims over live for some time, and sometimes even survive the hanging. A person can be saved by aggressive resuscitative measures if rescued within a few minutes of suicidal hanging. Only few persons survive this episode, if rescued promptly and usually die at a later stage, which more precisely can be called delayed hanging death. Here we report 3 cases of delayed deaths due to suicidal hanging with the victims eventually succumbing to one or more of the fatal complications after surviving for different time duration. The post mortem examination and histo-pathological reports confirmed the causes of death in these cases.

Materials & methods

The present study was carried out in the department of forensic medicine at Rajarajeswari medical college & hospital, Bangalore, India. The period of analytical study of cause of death of hanging is from January 2013 to June 2013. A cross sectional study of total 56 cases of deaths due to hanging has been studied.

Inclusive Criteria: All cases of deaths due to hanging of both sexes of all age groups, irrespective of duration of survival were included in the study.

Exclusive Criteria: Cases other than hanging to Rajarajeswari medical college & hospital, Mortuary. Detailed autopsy examination was done on the request from the investigating officer in annexure 146(i) and (ii). Relevant information was collected from police, relatives, friends of deceased and hospital records. Rokitansky enmass evisceration technique was followed in conducting the autopsy. Then with all these findings, post mortem and histopathology conclusion as to the cause of death was drawn and analyzed.

Results

In 56 cases, death occurred immediately in 53 cases after hanging, in remaining 3 cases death occurred after few days of hanging.

Case 01

Deceased was a 22 year old male who survived for 3days following hanging with mechanical ventilator support. He was clinically diagnosed to have suffered hypoxic ischemic encephalopathy and aspiration pneumonia due to hanging. The patient was on a mechanical ventilator for 3days. On postmortem examination the external features were unremarkable except the presence of faint ligature mark over the neck. On internal examination brain was edematous, the lungs were edematous, features of consolidation were noted, and on cut section of lung pus mixed froth was noted. Histopathology of brain showed features of hypoxic encephalopathy with pulmonary edema. Death is due to hypoxic encephalopathy and pulmonary edema consequent upon hanging.

Case 02

Deceased was a 30yr old female who survived for 6days following hanging. She was on mechanical ventilator. After 5days of intubation, she developed seizures & died of cardiac arrest. On postmortem examination external features were unremarkable except for the presence of ligature mark over the neck which was partially healed. On internal examination blood stained froth present in the larynx & trachea. Both the lungs were edematous & features of consolidation present. Brain was edematous. On cut section blood mixed pus present. Stomach showed presence of 50ml of blood. Histopathology confirmed the pulmonary edema of lungs with hemorrhage. Death is due to pulmonary edema and hemorrhage consequent to hanging.

Case 03

Deceased was a 53yr old male who survived for 36hrs following hanging. He was intubated & finally died due to Hypoxic encephalopathy & aspiration Pneumonia. On postmortem examination ligature mark was present over the neck. Both lungs were edematous and had consolidation features. On internal examination fracture of superior horn of thyroid cartilage & greater cornu of thyroid cartilage was noted. Death is due to complications consequent upon hanging.

Discussion

Hanging is a form of asphyxia death due to constriction of the air passage at the neck, as a result of suspension of the body by a ligature in the form of a noose, applied in such a manner when weight of the body acts as a constricting force [2]. Death occurs within 2-3 minutes in majority of hanging cases. In our study, instantaneous death occurred in 50 cases, most commonly due to asphyxia and venous congestion. Death usually occurred immediately after constriction of neck due to obstruction of the airway either through compression of the trachea or displacement posterior of the tongue and floor of the mouth resulting in asphyxia and associated venous congestion in most of the cases. Ischemic cerebral damage due to neck compression caused by compression of the blood vessels of the neck resulting in insufficient amount of oxygenated blood reaching the brain is seen in most of the cases [3]. While the remaining 3 cases showed delayed death following hanging. Prinsloo and Gordon, Sapiro and Meritz described late causes of death in hanging a few decades ago and Narayan Reddy has thrown some light on the same [2].

In the present study delayed death is mainly seen in male which is consistent with

existing literature on delayed hanging deaths which is predominantly seen in male, with an average age of 40 years [4, 5]. The clinical features of a patient of hanging involve respiratory and central nervous system signs and symptoms [6]. The common respiratory signs are respiratory distress, hypoxia, pulmonary edema etc; and signs related to CNS are like restlessness, unconsciousness, muscular rigidity, convulsions, amnesia, hemiplegia etc… [7].

Delayed death for several days is usually rare. Delayed death occurs due to aspiration pneumonia, infection, edema of lungs, edema of larynx, hypoxic encephalopathy, infarction in the brain, abscess of brain, & cerebral softening[2]. Delayed death can occur after any number of days. Most of the studies show that delayed death is most commonly due to hypoxic encephalopathy and pulmonary edema which is consistent with our study.

Hypoxic ischemic encephalopathy is an important complication in a patient who survives an attempt of hanging. Hypoxic brain injury or global cerebral ischemia occurs due to reduced cerebral blood flow over the entire brain. At the time of hanging, oxygen supply is decreased to brain because of pressure on carotid, severe enough to damage brain cells. This hypoxia ultimately leads to encephalopathy which is consistent with our case. Necrosis of brain cells leads to inflammatory reactions, which ultimately causes swelling and edema. Brain edema together with postural lung congestion and infection leads to respiratory failure [8]. Decreased perfusion of the brain occurs when blood flow to it is partially or completely restricted, when blood pressure is very low, or when circulation ceases entirely. These conditions deprive the brain not only of oxygen but also glucose and all other nutrients as well as the nutrient/waste exchange process required to support brain metabolism, resulting in the development of a hypoxic-ischemic state and resulting in death of the individual [6]. Most often it is the inadequate oxygenation and cerebral perfusion that result in the death of the patient [9].

Next common cause in delayed hanging death is development of pulmonary oedema. Development of pulmonary edema has played a major role as one of the causes of death in delayed hanging. The pathophysiology of type I post-obstructive pulmonary edema as in post hanging is thought to be influenced by both hydrostatic forcesand increased permeability of alveolar epithelium following sudden upper airway obstruction [10]. Pulmonary capillary membrane damage leads to increased capillary permeability, hyperemia in the lungs due to abrupt fall in intrapulmonary pressure following sudden removal of airway obstruction and pulmonary vasoconstriction mediated by vasoactive substances like histamine, serotonin and kinins; the release of which is triggered by cerebral hypoxia [11]. If patient is rescued within few minutes of hanging, may be saved from pulmonary edema by applying specific resuscitative measurements (12). The other rare causes for death in delayed hanging are aspiration pneumonia, brain absess, septicemia etc. Victim of hanging usually die within period of three to five minutes [13]. In our study 3 cases succumbed to delayed death, after variable durations ranging from 3 days to 6 days. Pulmonary edema and hypoxic encephalopathy are the most common complications. If patients rescued within few minutes of hanging, may be saved by applying specific resuscitative measurements and usually die at a later stage. In our study all the 03 cases were in unconscious state till the death which is consistent with study by maxeiner where he reported delayed hanging death in six cases of suicides who were all unconscious throughout till death (14). In another study from Delhi, an uncommon accidental hanging of an adult male was reported who got trapped in the lift of a building and was accidentally hanged. He also survived for 39 days in the hospital and died (15). Aggarwal et al from Delhi (India) reported a similar case where a 20year old female survived for nine days in the hospital being unconscious throughout, after a hanging episode and died ultimately due to cerebral anoxia [6]. So delayed death can occur after any number of days following hanging.

Conclusion

Hanging is a painless method of committing suicide and death is instantaneous. Only few persons survive this

episode and usually die at a later stage. Most of the delayed death is due to hypoxic encephalopathy and pulmonary edema which is consistent with our study. If above complications are promptly treated patient may be saved from delayed deaths due to hanging.

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Conflict of Interest

None Declared.

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Case Report

AN UNUSUAL FATAL INJURY DUE TO A CRIMPING WIRE MESH MACHINE

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Abstract

An occupational fatality is a death that occurs while the person is at work or performing some work related tasks. Common causes include falls, machine-related incidents, motor vehicle accidents, electrocution, and falling objects etc. Machine related incidents can occur in any industrial, mining or agricultural settings due to involvements of various types of machine equipments. Crimped wire mesh machine is used to manufacture various types of wire mesh products for household and industrial settings. Authors here report a case of a worker who was accidently injured after his pelvis got hit by two heavy metallic plates of the crimp wire mesh machine. He suffered right acetabular fracture and died after one day of survival owing to hemorrhagic shock. The circumstances which led to death of the worker, risk factors involved and preventive measures to avoid such types of accidents are discussed.

Keywords: Pelvic Fracture; crimped wire mesh machine.

Introduction

Crimping is the process of joining two pieces of metal or other ductile materials by deforming one or both of them to hold each other and the deformity thus produced is known as the crimp **[1]**. It is used to form crimped wire mesh which can be classified according to use as galvanized or stainless steel, according to the loading capacity as heavy and light and according to the type of wire into welded, woven or knit wire respectively **[2]**. The main applications of welded wire mesh (heavy duty) are in commercial and industrial settings to create barriers and for security purpose. Woven wire mesh (wire cloth) is widely used in household settings as screens for doors and windows for shelving and fencing purposes. Knit wire (chicken wire) is used as an inexpensive barrier for livestock **[3]**. The machines utilized may be fully automatic ones which are absolutely safe and even the semi-automatic ones are not directly hazardous. The remote possibility of a person sustaining injuries while working on these machines may include the high power electricity or very rarely the hazard of the impaction of some body part between the two moving heavy plates as implicated in the present case. These types of cases are extremely uncommon and rarely reported in Forensic literature. The present case is unique because here it involved the rare combination of the carelessness of the worker and the faulty make of the machine with absence of inbuilt safety mechanisms along with the accidental intervention of the aged factory owner resulting in fatality.

Case report

A 25 year old average built person, working in a factory was tightening the loose pulley nuts of the crimped wire mesh machine. While he was engaged in repairing,

he asked the aged factory owner to pick up the fastener nut bolt lying near the accelerator. The owner while picking up the fastener nut got his foot inadvertently stepped on the accelerator and the plugged in machine stroked accidentally. The deceased's lower trunk got trapped between two heavy blades of machine and his pelvic region was severely injured. He was immediately taken to a private hospital where he was diagnosed to be a case of fracture pelvis due to blunt trauma and intervened surgically but expired during the course of treatment after one day of survival.

At autopsy

It was a dead body of a young male wrapped in hospital sheet. Average in built and height was 160 cm. The abdomen was tense.

Externally there was a contused abrasion, reddish blue, 2.0 cm × 2.0 cm, present over the outer aspect of the right buttock. Contusion, bluish black, 45 cm x 38 cm present over the lower abdomen and front of the right thigh **(Fig 1).** This on dissection revealed underlying closed fracture of the right ilium extending into the acetabulum with effusion of the blood in the joint space and the surrounding musculature with evidence of associated arterial injury in the form of oozing of blood on pressure.

Fig 1: Extensive bruising present on the upper part of right thigh.

All the internal organs viz. Lungs, Liver, Kidneys and Brain were pale. Lungs on cut section expressed frothy fluid mixed with blood. The peritoneal and pelvic cavity contained fluid blood and blood clots weighing 1430 grams and 800 grams respectively **(Fig 2).**

Discussion

Death due occupational trauma is well known and the common causes are like vehicular accident, falls from a roof, machinery, electrocutions and falling objects. Machinery-related fatalities are one of the leading causes **[4]**.

Fig 2: Acetabular fracture with extensive intra-abdominal hemorrhage.

Out of 153 fatal occupational deaths, machinery-related incidents reported in 5 (3.3%) cases in construction sector of Turkey **[5].** According to National Crime Record Bureau (NCRB) India report 2012, A total of 3,94,982 accidental deaths were reported in the country during 2012 (4,098 more than such deaths reported in 2011) showing an increase of 1.0% as compared to 2011. Correspondingly, 0.3% increase in the population and a marginal rise of 0.9% in rate of 'Accidental Deaths' were reported during this year as compared to 2011. Death due to machine accidents commonly seen in workplaces such as primary industry, agriculture, construction, forestry, fishing, mining, and transportation/ communications/ utilities industries etc.

Crimping is extensively performed in metalwork industries with the help of different models of automatic, semi-automatic and hydraulic machines to manufacture various types of wire mesh products. The crimping wire mesh machine comes with a code of 4558 of the California Labor Code Section and is included in the category of Power Press machine **[6]**. It is entirely different from the molding machine with rotating heads (blades) used for recycling products.

In California during 1996 **[6],** there was a report about one non-fatal case where

the employee's foot and ankle were pulled into the rollers with the mesh. At enquiry it was found that there were neither guards on the back or input side of the rollers nor any control devices on the input side of the machine where the employee was injured. In Singapore during 2008 **[7],** a fatality was reported where a worker got killed by a steel mesh machine when the interlocking sensors were not connected and hence not in working order while testing and commissioning of the wire mesh machine was being carried out. There is one more report by B Singh et al. **[8]** of a non-ballistic penetrating injury by a metal piece which accidentally got separated out from the metal sheet of a rolling machine fatally injuring the visceral organs.

In our case the crimping machine was used for manufacturing of wire mesh products. This type of setting requires a minimum of 4 workers without the absolute necessity of any sales tax number/registration or any other authorisation/licensing which may be required small scale industries. The deceased foremen, who was an operating technical hand, was working in the set up for the last 6-7 years. He was an experienced but uncertified worker. While he was just trying to fix the loosened nuts of the pulley of the machine, one nut bolt fell down. He asked the aged owner of the factory, who was standing nearby to pick up the bolt and in the act the foot of the owner stepped on the accelerator pedal of the machine the plug of which was already in socket and the machine was in "On" mode. The foremen was not wearing any protective gadgets nor there was any provision of any interlocking guards/sensors as the machine was an indigenously assembled one **(Fig 3 and Fig 4).**

Fig 3 Indigenous Crimp wire machine (metallic plates in apposition)

Fig 4: Crimping machine with un-apposed metallic plates (arrow showing the position of the worker at the time of accident).

Moreover the worker failed to ensure the machine to be in unplugged position before he embarked to fasten the nuts and the owner also did not notice to inform the worker about the same. The old age of the factory owner can also be attributed as one of the risk factor related to poor body control or reflex activity which has resulted in accidental stepping on the accelerator. The heavy plates of the machine with a large surface area stroked apposing each other and thereby impacting the lower trunk of the foremen standing in between. The impact resulted in high velocity blunt trauma to the pelvis causing vascular and bony injuries.

Risk factors which mostly contribute to fatalities in industrial set ups involve faulty make of the machine and the carelessness of the workers. They do not adhere to the laid down specifications for safety measures. However in developing countries, where industrial equipment's are locally assembled ones, there is no question of manufacturer's specifications and chances of injuries are all the more high. The body parts can be crushed, both between parts moving together or towards a fixed part of the machine, wall or other object, and two parts moving past one another can cause shearing.

Methods such as interlocking the guard should be a mandatory safeguard in power press machines so that the machine cannot start before the guard is closed and cannot be opened while the machine is still moving. Control any remaining risk by providing the operator with the necessary

information, instruction, training, supervision and appropriate safety equipment **[9].**

Precautions must be taken during work, and installation of safety measures should be placed at workplace. In order to perform adequate risk assessment of injuries that occur in the workplace, health and safety professionals use resources such as the Haddon Matrix. This model assesses the risks leading up to, during, and after a death in order to prevent future incidents of a similar nature. Employers and employees can learn how to identify risk factors in their work environment in order to avoid incidents that may result in death **[10].**

Conflict of Interest

None Declared

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Review Article

SUICIDE BY MEDICAL STUDENTS – A DISTURBING TREND

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Abstract

Suicide has achieved an epidemic proportion in among the medical students of our Country. This is an alarming trend. Saddest part being, these young students, after putting lots of hard work, gets admission in a Medical College. They are choosing a fatal end, which is preventable. The way out of this problem is a difficult. The answer may lie in providing professional counselling and creating opportunities for de-stress and recreational activities during their stay in Medical College.

Keywords: Suicide, Vipassana meditation, Distress, Depression.

Introduction

Suicide is derived from a two words Sui (to oneself) and Cide (killing of) and is used to donate self-planned and deliberate termination of one's life. It is distinctively a human affair only, men can decide to kill themselves [1] In this act human being destroys the thing he loves most- himself. The primary motive of suicide is often not death but some other purpose, such as communication of distress, blotting out of unbearable state of mind or trying to change behavior… to enhance the impact [2]. Human brain innovates various methods to execute this self destruction. Among individuals committing or attempting to commit suicide many, especially Medical students are well aware that Under Sec.309 IPC. Whoever attempts to commit suicide or does any act towards the commission of such an offence is liable to be punished with simple imprisonment up to one year or with fine or with both.

Act of suicide is the result of a complex interaction between one's mental condition along with social, cultural, environmental and biological factors working on individual's life leading to Suicidal impulse. Etiology of suicide - Genetic predisposition, Central serotonin levels, Physical and Psychological disorders [1]. Suicide is preventable, if recognized and adequate measure is taken.

As per WHO, Every year, more than 800,000 people die from suicide; this roughly corresponds to one death every 40 seconds. Suicide is among the three leading causes of death among those aged 15-44 years in some countries, and the second leading cause of death in the 10-24 years age group; these figures do not include suicide attempts which can be many times more frequent than suicide (10, 20, or more times according to some studies). Suicide worldwide was estimated to represent 1.3% of the total global burden of disease in 2004. Mental disorders (particularly depression and alcohol use disorders) are a major risk factor for suicide in Europe and North America; however, in Asian countries [3].

Case report

Medical student jumps to death- A final year MBBS student of a Medical College & Hospital leapt to death from the terrace of the five storey men's hostel on the campus on Friday morning. Classmates say he was depressed because he had been given zero in practical paper [4].

Medical student found dead on tracks- A final year student of another Medical College & Hospital was found dead near Mathurapur railway station on Saturday… failed in a subject and had to sit for supplementary examination [5].

Drug use hint in SSKM doc death- A medical Intern of another Hospital was found dead and another critically ill…over two dozen syringes, vials and foils of heroin and other drug paraphernalia lay scattered in the room, leading police to suspect a massive drug overdose **[6].**

Discussion

Out of the total number of suicides reported in India, 5% were estimated to be committed by students, main reason being 'failure in examination' (1.6%) and 'professional/career problem' (1%) [7]. Statistics indicate that more and more students are opting for suicide every year as a means to "end their suffering" which could be prevented by timely intervention [8]. Medicine is one of the most stressful professions. Death by suicide is a major occupation hazard amongst physicians. This increased risk may begin during medical school [9]. Studies suggest that the suicide rate among medical students is higher than in the age-matched population. Suicide is reported to be the second most common cause of mortality among medical students in USA [10].

However, there is paucity of data on suicidal ideation and thought among medical students especially in India [11].

It is difficult to ascertain causes of de-motivation among medical students leading to suicide. The factors which operate may be depression because of poor performance, failure in the examinations, inability to cope with long hours of study, coupled with family, financial or emotional problems. Use of drugs/alcohol for stress relief along with knowledge about and easy access to lethal drugs may contribute to high suicide rate.

In the cases cited the Medical students choose the path of suicides because of failure in examination leading to commission of suicide. Death of medical intern was due to use substance abuse.

Whatever may be the background of suicide, the hard fact remains, suicide is preventable. Most of the suicide victims' shows some warning signs and symptoms, which if recognized early, timely action can be taken for prevention. Some common symptoms are severe anxiety or depression like insomnia, agitation, loss of interest in activities, alcohol abuse, feeling of worthlessness, isolation, self-criticism, and self-hatred.

Faced with reality of suicide it is high time suitable measures be in placed to prevent suicide. The measures may include psychological screening of the student at the time of admission. Medical College should select and admit students who are mentally fit, psychologically sound and emotionally strong, keeping in view, it is a challenging job of a doctor. This is not a new concept, in Armed Forces Medical College, psychologist screen students before admission. After admission, students get adequate recreation in form of games, outdoor activities and cultural activities to reduce stress. Also mature and senior faculty members should interact with students to provide psychological support and guidance. Use of meditation to cope with suicidal thoughts and feeling [12] is one of the simplest ways to prevent suicide among medical community. Vipassana meditation [13] is one such method which is widely practiced in many American and European University in the name of Mindfulness Meditation.

Suicide assessment risk using SAD PERSONS scale is also an option for students at risk.

The SAD PERSONS scale [14] is an acronym utilized as a mnemonic device. It was first developed as a clinical assessment tool for medical students to determine suicide risk.

Calculation

The score is calculated from ten yes/no questions, with points given for each affirmative answer as follows:

- S: Male sex → 1
- A: Age 25-44 or 59+ years → 1
- D: Depression or hopelessness → 2
- P: Previous suicidal attempts or psychiatric care → 1
- E: Excessive ethanol or drug use → 1

- R: Rational thinking loss (psychotic or organic illness) → 2
- S: Single, widowed or divorced → 1
- O: Organized or serious attempt → 2
- N: No social support → 1
- S: Stated future intent (determined to repeat or ambivalent) → 2

This score is then mapped onto a risk assessment scale as follows:

- 0–5: May be safe to discharge (depending upon circumstances)
- 6-8: Probably requires psychiatric consultation
- >8: Probably requires hospital admission

Conclusion

Doctors are the agent to treat and cure illness; it is ironical that doctors are now are becoming the victim of illness leading to suicide. This is a strange paradox, but true. A little vigil with a high index of suspicion among fellow students may be sufficient to prevent this malady. There is an old saying "Healers' heal themself". Probably time has come to pay attention to this saying.

Conflict of interest

None Declared

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Review Article

ANCIENT DNA ANALYSIS AND ITS PROBABLE APPLICATIONS IN FORENSIC ANTHROPOLOGY

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Abstract

The introduction of molecular techniques in biological anthropology has opened up new possibilities in the discipline. Ancient DNA studies have answered a number of archaeological, paleontological and forensic anthropological questions as it exposes the identity of our ancient ancestors through molecular techniques from ancient/exhumed skeletal remains. The retrieval of DNA sequences from skeletal remains like bones and teeth can reveal the genetic and evolutionary history of humans as well as can reveal routes of ancient human migrations. The lineages of our ancient ancestors have survived by chance in the special pieces of DNA. Human genome contains many genetic traits of their contemporaries which help in identifying the most recent common ancestors. Though DNA is passed on from one generation to another and gets mixed up in the progeny; however, special pieces of it remain unaltered and are subjected to inheritable genetic mutations. The number, rate and order (time) and age of these mutations can be determined since the time they appeared and hence their time of burial can be predicted. Modern humans are thought to evolve from a common female ancestor some about 1, 40,000 years ago in sub-Saharan Africa. It has now been estimated that the limit for DNA preservation is approximately 19.000 years at 10°C, hence specimens from any site that has a thermal age normalized as 10°C >19.000 years are unlikely to contain ancient DNA. Presence of PCR inhibitors, endogenous DNA, damage and fragmentation are the main challenges commonly encountered in ancient DNA analyses.

Key words: Forensic Anthropology, ancient DNA, mitochondrial DNA

Introduction

Ancient DNA is any genetic information retrieved from any preserved biological/organic remains, ranging from extinct taxa to recently deposited hair or faeces. The first ancient human sequence was decoded in 1985 from a museum specimen of Egyptian mummy [1], though first reported aDNA sequence was from Quagga [2] in 1984 (an extinct member of horse/zebra family). The earlier studies were primarily limited to the degraded and fragmented nature of aDNA; mostly caused by hydrolytic and oxidative forces acting postmortem. Ancient DNA (aDNA) is used to investigate the extent and patterns of genetic diversity in past populations and to assess the effects of gene flow, genetic drift, and population bottlenecks across time and space (3-4). Ancient DNA studies provide important benchmarks not

only for evaluation of coalescent models in genome evolution but also for testing general demographic models of development of genetic diversity in different populations. The vast majority of aDNA studies have been focused on mtDNA, because of its high copy number per cell, maternal inheritance and rapid evolution. Genetic drift, population movements (migration), and other demographic processes have altered the world. Accordingly, aDNA studies contribute to our understanding of demographic history and require enhanced geographic as well as temporal sampling (5). Molecular biological technique of aDNA analysis has become commonly applied to archaeological science [6]. aDNA study is regarded as a newly emerging research and has attracted keen attention from the scientific community [7]. Ancient DNA study can provide crucial genetic information on bodies buried in ancient tombs or even on genetic lineages of human populations, information of which could not easily be derived by other studies [8].

Basics of Ancient DNA analyses:

Most of the DNA passed from one generation to next and is mixed by meiotic processes in gamete formation that make each individual unique from his/her parents. But special pieces of DNA remain virtually unaltered when it passes from parents to child. One of these pieces is carried on the Y-chromosome which is passed from father to son, whereas, another piece (mtDNA) is passed from mother to the child. DNA on the Y-chromosome is like a genetic surname that allows men to trace their paternal lineage. Mitochondrial DNA allows both sexes to trace their maternal lineages. Both types of DNA are subject to occasional harmless mutations that become inheritable genetic markers. After several generations a particular genetic marker is carried by almost all the male and female descendants inhabiting the region in which it arose. When people migrate out, they carry the marker with them. Some regions of mtDNA mutate faster than others, thus inserting uncertainty (or errors) in broad margins of ages determined from mtDNA. Furthermore, mtDNA cannot be used to study the ancestry of maternal grandfather and Y-Chromosome DNA cannot be used to study the ancestry. Thus, each marker in a person's DNA represents a location and migration pattern of that person's ancient ancestors [9].

Such a molecular lineage can be better understood with the example of a 'unique baton' with identifiable markings made by the first ancestor. This genetic baton, in the form of mtDNA was passed from mother to daughter through the ages with some new mutations after a definite time span, that also serve as markers. As people migrated from the original location after inheriting the mutative change (new marker) from the mother, many copies of this genetic baton arrived in new locations. As migrations continued, the baton with new markings was copied in different areas of the world and new makings are added. But even after 140,000 years later, the baton still can be studied to indicate the time of its first appearance, and hence, conclusions can be made about the people in whom it first occurred. Thus, by diligently tracing new markings or mutations, one can determine the time and origin of these mutations by studying various population groups that tell the story of their migration and migration patterns [10]

Nuclear markers on sex chromosomes are often used to genetically determine sex of ancient individuals but they can also be used to identify maternal (X chromosome)`or paternal (Y Chromosome) lineages and to detect genetic diseases. Autosomal nuclear markers can be utilized for paternity and maternity testing and to detect occurrence of potential genetic diseases or geographically specific variation. As mtDNA is passed only from mother to child, its analysis allows us to trace maternal linage through time The mitochondrial markers are prone to relatively higher mutation rate and are often geographically specific, being limited to distribution to a single tribe (private polymorphism).

Mitochondrial DNA is transmitted in almost all cases from mother to daughter and it does not combine with other DNA. It undergoes mutative changes at a higher rate than nuclear DNA, and the rate and order (time) of these mutations can be followed and back-calculated through time to determine the period when no mutations existed. As successive mutations occur at a fairly regular rate, some mutations occur before others and this sequence is used to date the time of

mutations. In this way, the time of emergence of earliest ancestor or owner of skeletal remains can be determined from whom the rest inherited the mtDNA. A comparative study of mtDNA from people of many different geographical regions reveals the number and order of mutations that have occurred since the emergence of the most recent common ancestor. Once the rate of mutations is determined, their time of emergence and time of burial of skeletal remains can be estimated by counting the number of mutations that have occurred since its appearance.

Ancient DNA and Anthropology

The first ancient DNA studies used bacterial cloning to amplify small sequences retrieved from skins of animals and human mummies, suggesting that genetic material surviving in ancient specimens was often principally microbial or fungal in origin and such endogenous DNA was in small concentrations with short damaged fragments of multi-copy loci such as mitochondrial DNA (mtDNA). The PCR made it possible to amplify and study even a single surviving ancient DNA molecule. On the other hand, the lineages of our common ancestors are identifiable through the surviving pieces of DNA (mtDNA) that are passed down the gender lines nearly unaltered from one generation to the next. Analysis of multiple human mtDNA samples from a population can help understand methods of population genetics, cconstruction of phylogenetic trees, estimates of genetic diversity, genetic distances between populations, and estimate of gene flow between populations. Chloroplast DNA can be used to trace maternal of paternal lineage of plants, to identify plant genus or species (11-12). Earlier estimate of recovery of ancient DNA from remains were not more than a million years old specimen though, recent studies show that DNA cannot survive significantly longer than 130,000 years even under the best circumstances (slightly exceeding earlier estimates).

Role of aDNA in Migration Patterns

In this era of globalization, universalisation and migrations, it is not certain that a skeleton found in a particular locality belongs to the most common ethnic group or race. It is a fact that population migrations/movements occurred due to rapid changes in material culture. Some questions about human migrations and evolution cannot be answered by traditional anthropological techniques but through application of new techniques developed in molecular biology like aDNA analysis. Physical anthropologists have since long used the molecular methods of present day populations to elucidate human variability and human prehistory. Ancient DNA techniques facilitated incorporation of the temporal component in molecular analyses. It has been used to produce previously unobtainable data which helped to resolve some traditional anthropological research problems. There are two competing theories in anthropology about origin of humans: humans originated in multiple areas independently, and humans came from one common ancestor (13). Studies on the molecular ancient DNA provide strong evidence that we came from one common ancestor. Modern humans first arose in sub-Saharan Africa and then began migrating to India, China, then to Europe and eventually across the Bering Straits to North and South America. Many changes in aDNA allowed us to adapt to different climates and conditions, including changes in our skin colour, nose form, facial characteristics, certain body ratios etc (10, 13). The spread of people and genetic characteristics they developed allowed humans to adapt to different regions and climates in the world, facilitated by culture. Scientists are unanimous that migration came in waves, and that different ancestral populations moved into places like India at different times, all originating from Africa. Later, the migrant groups continued to move on to other parts of Asia and south-east Asia (14), and onwards to Australia. These studies highlight our common ancestry and at the same time, they reflect how closely people are related to one another as a part of extended human family. Such analyses provide a detailed snapshot of human genetic variations, modes and patterns of migrations that led to populate the various regions of the world together with the influence of effect of culture on adaptations and patterns of genetic diversity. These studies allow their databases to be used for medical research for curing genetic disorders and gene therapies.

There are several other anthropological benefits of ancient DNA analysis like to have insight into patterns of

human evolution and migration including other important issues of human history such as changes in population structure and movement patterns, language evolution, genetic admixtures, phylogenetic relationships, prehistoric population sizes, origin and pathways of transmission of infectious diseases etc. Ancient DNA studies can also be used to check whether genetic diversity of animal populations has changed overtime or not, to redress the problems as to phylogeny, phylo-geography and population history of extinct and extant species and to study the phenomenon of co-existence of distinct groups of human species. It allows the understanding of the affect of cultural activities on genetic properties of man and man-like species like Neanderthals and other fossil hominids. It allows further studies in the field of inherited and acquired diseases and natural immunity such as the immunities by tiny deletions as in the case of smallpox or plague.

Non-human ancient remains help reconstruct various aspects of human prehistory like to understand hunting and dietary behaviours, track domestication of various species, track history of ancient diseases, reconstruct environmental conditions and to as proxies for human movements. Ancient DNA can also be used to reconstruct ancestor-descendent relationships between populations. It is used to highlight patterns of interrelatedness between ancient groups at different levels of shared material culture. Molecular data obtained from ancient human remains can elucidate the pattern of social structure like social status, marriage patterns, burial customs and differential patterns of disease and mortality by sex. It facilitates sexing of fragmentary and sub-adult human remains and development of an understanding of spatial patterning of maternal and paternal lineages across burial grounds

Ancient DNA and Forensic Anthropology:

The international human right organizations has brought to light a number of disguised mass- graves with buried skeletons of a large number of soldiers, suspected to be killed in action (KIA) or as prisoners of war (POW). Morphological skeletal features of such remains fail to assess their identity, so some molecular methods like aDNA analyses are employed. Most of forensic anthropological identification methods are based on the analysis of morphological and genetic markers of bones and teeth. Initial ancient DNA attempts are 2-3 decades earlier but its methods and standards are evolving rapidly. Sometimes, wildlife or museums skins are also brought to a forensic scientist for identification purposes as to their species origin or sex estimation. Morphological features don't facilitate such identification, so aDNA technique gives useful results

Genetical sexing is particularly useful in cases of recovery of fragmentary remains or of juvenile or infants. Ancient DNA studies allow us to determine the sex of individual using markers on the X and Y chromosomes. It can also identify the uniqueness or individuality of an individual. Mixed remains can be sorted into a minimum number of individuals and dis-articulated remains can be re-associated. Ancient DNA studies are also used to confirm the presence of disease causing organisms or infectious agents, if morphological attributes suggest that an individual suffered from a genetic or infectious disease (15).

Individuals with known living descendents could be individually identified through comparison of their ancient DNA with that of their putative descendents. Identifying sex of ancient remains helps us to have an idea of differential mortality rates. It also allows us to explore differential sex-biased patterns of diseases, dietary status and material possessions (atleast from grave goods). Sex specific information of mortuary rites and mortality rates reflect some sort of conflict and power struggle. All of these facts have some important implications for prehistoric and historic human sources as well as descendants of such remains.

Forensic experts are frequently interested in reconstructing the environment in which crime occurred. Understanding the ecology of crime scene can provide insight into it. Environmental reconstruction is undertaken by identifying the floral and faunal remains at a site and inferring the local environment. The dietary patterns of deceased can be assessed from molecular analysis of coprolites by amplifying sections of mitochondrial and chloroplast genomes. Even

aDNA can be extracted from the outer surface of weapons or tool used or wax, glue etc., used to bind parts of a weapon. aDNA techniques have also been applied to questions of patterns of even prehistoric diseases. Various infectious diseases leave similar skeletal pathologies on human remains and their patterns are indistinguishable from each other or from inherited diseases (16). Mycobacterium *tuberculae*, Mycobacterium *Leprae*, Yersina *pesteris* etc., have been identified from teeth or bone specimens showing morphological pathologies and not others. If morphological evidences suggest that an individual suffered from a genetic disease, then that region of gene which is associated with the disease could be amplified from ancient DNA and mutations associated with that diseases could be detected. Ancient DNA can even be extracted from plant food containers or animal skin containers (17) where crime weapons are usually kept after committing a crime..

Forensic anthropologists are sometimes called for giving opinions about the grave remains. Maternal and paternal lineages can be inherited using mtDNA and Y-chromosome DNA, respectively. If long, highly variable DNA sites are observed, then people are from some archaeological site of region. And who share identical, relatively rare mutations are likely to be closely related because they are not separated by enough generations for a mutational event to have occurred. An individual (except meiotic mutational event) will share identical mtDNA mutations not only with his/her mother but also with siblings, maternal grandmother, maternal aunts and uncles, maternal cousins. Similar is true for Y chromosome DNA but for male cousins uncle, brother etc. Identification of lineages or family relationships from archaeological records help in testing hypothesis of social structure, marriage patterns and burial customs of prehistoric societies.

Sources of Ancient DNA and their extraction methods

Ancient DNA has now been successfully extracted from a wide variety of organic remains including teeth, bone and preserved or mummified soft tissues. Quantity of DNA available in ancient samples is highly dependent on the condition of the archaeological site from which they have been excavated and much less on absolute age of the sample (18-19). It can also be extracted from other resources (not ancient in strictest sense) such as skins held in museums, horn, tusks, hair, faeces, fur etc. Like truly ancient samples, these resources also have fragmented genomics but predominant presence of PCR inhibitors. There is sufficient evidence today to be confident that ancient DNA can be recovered from a multitude of resources dating as far back as tens of millennia in the past or recent past. PCR has revolutionized by invention and development in ancient DNA studies remarkably increasing our ability to reliable and reproducible way to type ancient genetic markers.

Proper extraction and analysis of ancient DNA are quite complicated and methods continue to evolve. A number of DNA extraction protocols from ancient skeletal remains have been proposed by different workers (20-23). Some of them have focused on unconventional methods like purifying with water or some other reagents; others have focused on purifying extracted DNA with silica binding. Most extraction methods rely on release of DNA by degrading the hydroxyl-apatite by adding competing ions to bone apatite, and sometimes not considering bone apatite. Most popular extraction methods are based on phenol/chloroform extraction, alcohol precipitation and silica binding. The most recent method is based on a combination of EDTA decalcification and silica purification. The ownership rights of museum curators of human archaeological specimens make its detection and authentication impossible. It is easier to explain the absence of aDNA than to prove its presence in such specimens. There is general agreement on standard protocols to prevent and detect contamination which are especially important to follow, in analyses of unique or extraordinary samples.

Likelihood success of its availability can be predicted from the gross morphology of the sample. Except the sample that has been mineralized, the harder a bone or tooth sample is, greater is the probability of intact usable DNA in that sample. Before extraction, surface of sample is treated to remove contaminating DNA (exogenous). It can be

done by physically cleansing the sample surfaces, treating it with bleach, irradiating it with UV radiations. Then the sample is broken to expose internal surfaces, treated with proteinase enzymes and detergents. The digested sample is subjected to one of the two protocols (1, 3):-

(a) Phenol/chloroform extraction involves incubation with an organic phase (phenol/chloroform) into which many of cell components migrate, leaving the DNA in aqueous phase.
(b) Alternate approach involves introduction of silica power to the digested sample to which DNA kinds under influence of guanidium-thiocynate, allowing the remainder of contents of the digest to be washed away.

DNA extract is then concentrated and the sections of interest is copied or amplified using the PCR. The hyper-variable region of the mitochondrial genome is the most frequently targeted DNA section. Particular selection of DNA is chosen because mitochondrial genome is present in multiple copies in most cells, increasing the likelihood that at least a few copies will survive for substantial period of time. Once amplified, DNA of interest can be examined by direct sequencing by using restriction enzymes that cleave the DNA at specific sequences or by other standard methods to highlight sequence-differences between individuals. The resulting DNA data can be analysed in different ways to recognize meaningful patterns in variability between individuals and groups.

Ancient DNA Degradation:

The postmortem DNA decay is characterized by strand breaks, baseless sites, miscoding lesions and cross-links etc., which cause sequencing artifacts with a general bias towards CG-TA transitions and to a lesser extent to AT-GC bases. The higher frequency of former bases appears due to high rates of hydrolytic deamination of cytosine or its homologue 5-methly cytosine to uracil and thymine. The miscoding lesions are not randomly distributed across the mtDNA genome but are concentrated in 'hot-spots' where repeated hits occur. The description of these regular damaged sites in humans is very similar to regular evolutionary substitutions meaning that aDNA damage can generate sequence artifacts that mimic evolutionary changes.

The damage or contaminations makes impossible the application of various molecular biological techniques that can lead to erroneous estimates (24). In forensics, bones and teeth are primarily used for ancient DNA extraction and amplification but hair is the best choice as the later is less susceptible to contamination. The porosity of bones and teeth and bones is the main entry route for exogenous DNA (sweat, skin fragments, exhaled cells) making them unsuitable for such studies. Small amounts of exogenous human DNA contaminating the reagents used for extraction can present themselves as double sequences at polymorphic positions. Such problems can be overcome by rigorous precautions taken in preparation and handling of solutions as well as use of disposable glassware throughout (20). Many excavated ancient remains appears to have DNA from multiple individuals that adds to the problems for authentication of ancient human DNA especially when unique sequences are available such as Neanderthals, Homo erectus, Cro-Magnon man and other distinct modern human groups. Additionally, ancient DNA specimens contain a large number of PCR inhibitors that interfere with its amplification and purification. The preserved DNA is damaged overtime by hydrolysis and oxidations leaving only trace amounts of DNA containing cross-links and modified bases. The survival of ancient DNA in human skeletal remains does not depend upon the chronological age of the specimen but on their thermal history.

The retrieval of ancient DNA sequences from archaeological, forensic anthropological and paleontological specimens is no more a routine process because ancient DNA specimens contain a large number of PCR inhibitors that interfere in its amplification and purification (25).The preserved DNA is damaged overtime by hydrolysis and oxidation leaving only traces amounts of DNA containing cross-links and modified bases. Survival of ancient DNA in human skeletal remains does not depend upon the chronological age of the specimen but on their thermal history, as its

degradation occurs more rapidly at high temperatures (26). Ancient DNA is highly unstable, a property that causes methodological problems in such studies. In metabolically active tissues, damage to DNA molecule is rapidly and efficiently repaired via a number of repair pathways. However, in dead cells of archaeological samples like bones and teeth, fossilized remains, there is no such repair mechanism. Over time, the damage to the genetic molecules keeps on accumulating, primarily due to factors like spontaneous hydrolysis and oxidation. Most ancient specimens do not contain any amplifiable endogenous DNA, and if some have, they possess only fragments ranging from 100-500 Bp size.

Future Strategies:

Despite the number of problems and controversies with regard to working with aDNA, recent advances in the knowledge about the tempo and mode of DNA templates damage, sample contamination and biochemical diagenesis have improved the standards. Ancient DNA is now emerging as a viable scientific discipline to help reconstruct the patterns of evolution, population genetics and palaeoecological changes and means of forensic identifications. In the near future, more careful aDNA analysis will produce a progressive classification of aDNA sequences into 'dubious' or 'probable' categories. Such analyses have impacts in some larger areas like forensics, history of infectious diseases, genetic information about prehistoric domestic animals and cultivation such as maize and wheat which may lead to improvements in disease resistance or yield.

We can also expect analyses of entire prehistoric communities using well preserved material from permafrost or cave deposits. Vast numbers of larger mammals including horses, mammoths, moose, wolves, bears, hyenas and saber-toothed cats etc., are preserved in Arctic permafrost deposits. Genetic analysis of entire faunal communities will provide a better understanding of systematics and population genetics of prehistoric species. Thus, current levels of genetic diversity can be explained in terms of historical perspectives, giving impetus to molecular palaeontology and molecular paleoanthropology.

New applications of molecular biology techniques in the field of DNA may provide researchers with better approaches in the study of ancient DNA from humans, animal and plant remains and microbes (27). The possibility of retrieving DNA from ancient tissues have been viewed as holding the future promise of solving a variety of archaeological, anthropological, paleontological and medical questions. It is suggested herein that ancient DNA studies could shed more light on the co-evolution of hominids and humans and symbiotic bacteria as well as their co-evolution with microparasites.

Conflict of interest

None declared

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Review Article

METHODS IN MICROBIAL FORENSICS

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Abstract
A new subfield of forensics - microbial forensics - has been created, which is focused on characterization of evidence from a bioterrorism act, biocrime or an inadvertent release. Microbial forensic investigations involve evidence collection, handling and preservation, extraction of target, analysis of evidence and interpretation of results. The tools for attribution include genetic and non genetic based assays leading to high level characterization. An effective microbial forensics program requires validation of all aspects of the forensic investigative process from sample collection to interpretation of results.

Keywords: Microbial forensic, Bioterrorism, Methods, Validation

Introduction

Microbial forensics, a discipline comprised of several scientific fields, is dedicated to the analysis of evidence from bioterrorism event or a biocrime, acts to help determine the responsible party and to exonerate the innocent. [1] Microbial forensics has been implemented to enable better confidence in scientific analyses of forensic evidence and to gain greater confidence in the interpretations of the results obtained. Validity and rigor are essential for the tools of microbial forensics. [2]

A biocrime is similar to an assault crime, except, instead of a gun or knife, the weapon is a pathogen or a toxin. [1] The Centre for Disease Control and Prevention (CDC) has identified and categorized biologic agents that potentially could be used as weapons. [3] (Table 1)

Processes of microbial forensic: The various processes involved in the field of microbial forensics are; (i) sample collection and preservation (ii) extraction of target for analysis (iii) analytical component of the process (iv) interpretation of results.

(i) Sample collection and preservation:

The collection and preservation of microbial forensic evidence are paramount to efficient and successful investigation and attribution. In most microbial forensic cases, the sampling area, location, type of agent, and combinations of these variables are almost always novel. Therefore, instead of observing inherent rigidity in a standard operating protocol (SOP) for crime scene processing, best accepted approach for development of a sampling strategy in a particular case is to follow established guiding principles in combination with expert knowledge, investigative experience and common sense. [4] A targeted sampling strategy is the appropriate approach and should be

considered first when a biological agent is suspected. [5]

Recently, the American Society of Tests and Measurements (ASTM) International published a standard protocol for the collection of powders suspected of being biological agents. It is the first validated, standard microbial forensics method developed within the context of the environmental response and recovery efforts following the anthrax mail attacks in 2001.[6] Bio- Watch program is another nationwide aerosol surveillance system in U.S for sampling air for the presence of selected pathogens. [7]

(ii) Extraction of target for analysis:

The extraction and recovery of minute quantities of nucleic acids from dilute samples and complex matrices are very significant issues. [8] A wide variety of options exist for extracting nucleic acids for analysis. DNA extraction method suitability is determined by characterizing the extracted DNA's quantity and quality. DNA quantity is an indicator of extraction efficiency and quality parameters (purity and intactness) indicate DNA is free of PCR inhibitors and appropriately sized. [9] Inhibitors are likely to be in many samples due to environmental contamination. [8] DNA quality and quantity are evaluated with a number of different techniques. DNA quality is characterized in terms of purity using UV spectroscopy, presence of inhibitors using a PCR inhibition assay and intactness using gel electrophoresis. The most specific method for DNA quantification is quantitative polymerase chain reaction (q PCR) because it only measures the targeted organism's DNA. [9]

(iii)Analytical component of the process:

To enhance attribution capabilities, a major component of microbial forensics is the analysis of nucleic acids to associate or eliminate putative samples. [15] DNA/RNA typing figure prominently in the cadre of analytical tools for microbial identification and characterization purposes. [8]Various Nucleic acid based typing technologies include: PCR, real-time PCR, MLST (multilocus sequence typing), MLVA (multi-locus VNTR analysis), FISH (fluorescent in situ hybridization), whole genome sequencing and microarrays. [10] Additional new methodologies like Matrix Assisted Laser Desorption Ionization- Time of Flight (MALDI-TOF), Gas Chromatography- Mass Spectroscopy (GC-MS), Liquid Chromatography-Mass Spectroscopy (LC-MS) are also well established in resolving minor difference in proteins. These may help in identifying the unique protein signatures. [11]

While bacteria generally have fewer repeat sequences in their DNA than eukaryotes, a number of bacterial species contain repetitive elements and demonstrate substantial diversity at these sites. [12] As an example of the value of repeat sequence typing, was developing an investigative lead to determine the strain of the B. anthracis spores used in the 2001 mail attack case. The spores were determined to be of the Ames strain by using the multi-locus VNTR analysis (MLVA) .Simply knowing that the strain in the letters is rare in nature but common in the laboratory focused, the investigation process toward laboratory sources. [13] Earlier in 1993, the same MLVA was used to determine the B. anthracis strain used in the unsuccessful attack on Tokyo by the Aum Shinrikyo, which was identified as the veterinary vaccine strain .[14]

The ability of these high resolution DNA-based strain typing systems to differentiate an agent introduced in a bioterrorist attack from naturally occurring strains requires an extensive understanding of the diversity and distribution of the organism and its related species that share genetic traits. This is especially true for the Francisella group. Francisella species inhabit a wide variety of ecological niches. [15] It is placed among the categoryA potential biological terrorism agents. [3]

These analytical processes need rigorous validation necessary for high confidence or effective interpretation. Nucleic acid-based methods, although extremely important, are unlikely to pinpoint a unique source. Thus, chemical and physical analyses of evidence almost certainly will be needed to attempt to obtain additional information. [16]

(iv) Interpretation of results:

In the context of microbial forensic evidence, the results of interpretation relate to the identification of the microbial components in the sample and possible source attribution of the samples in the evidence. The validation process should determine the limitations of the test. It does not mean that a

test must be 100% accurate or have no false-positive or false-negative results to be considered useful. [2]

Role of validation in microbial forensic and its types:

A process for validation is essential in the development of methods that microbial forensics uses to generate reliable and defensible results. [2] The Quality Assurance Guidelines for microbial forensics issued by Scientific Working Group on Microbial Genetics and Forensics (SWGMGF) addressed the basic need for validation. [1]

The fundamental categories of validation are developmental validation, internal validation and preliminary validation. Developmental validation is the acquisition of test data and the determination of conditions and limitations of a newly developed methodology for use on samples. [17] Once a method has been developed and initially validated, it may be transferred to an operational laboratory for implementation. [2] Internal validation is an accumulation of test data within the laboratory to demonstrate that established method performs within determined limits in the laboratory. These two types of validation are crucial for addressing the reliability and robustness of any method routinely implemented in the laboratory. [17]

Preliminary validation is an early evaluation of a method that will be used to investigate a biocrime where the method used have not been through external and internal validation but are deemed necessary to support an investigation event. [2] One approach to acceptably achieve a preliminary validation is to convene a panel of experts, to assess the utility of the rapidly developed method, and to define the limits of interpretation and conclusions. Such an approach has been employed in the field of human DNA forensics for victim identifications in the disasters at the twin towers of the World Trade Centre in New York on September 11, 2001. [8]

Conclusion

The field of microbial forensics definitely enables better confidence in scientific analyses of forensic evidence. Currently, the United States is believed to possess most advanced capability for microbial forensics. In context to Indian scenario, till now there is no documented case of biological materials used by individuals, to intentionally cause harm to others. However, India is a country commonly threatened by terror attacks, there is no doubt that biological weapons may be made use of by illegal organisations. Therefore, Microbial forensics is an essential requirement in India to tackle such crimes if at all the need arises. [18]

Conflict of Interest

None Declared.

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Table 1 showing Centre for Disease Control and Prevention high consequence pathogens and toxins

Category A	**Category B**	**Category C**
Microorganisms that are easily disseminated from person to person, can cause high mortality, have major impact on public health. The toxin in this category is very lethal	Microorganisms that are moderately easy to disseminate and cause moderate morbidity, but usually low mortality. Toxins in this category can cause mortality	Emerging pathogens that could be engineered for mass dissemination are available, are relatively easy to produce, and have potential for high morbidity and mortality.
Bacillus anthracis	*Brucella* spp	*Hantaviruses*
Yersinia pestis	*Burkholderia mallei*	*Nipah virus*
Variola major	*Burkholderia pseudomallei*	*Tick-borne hemorrhagic fever viruses*
Francisella tularensis	*Coxiella burnetti*	*Tick-borne encephalitis virus*
Clostridium botulinum toxin	*Cryptosporidium parvum*	*Yellow fever virus*
Filoviruses (Ebola and Marburg)	*Escherichia coli* O157:H7	*Mycobacterium tuberculosis*
Arenaviruses (eg, Lassa virus, Junin virus, and Machupo virus)	*Salmonella* spp	
	Shigella spp	
	Vibrio cholerae	
	Chlamydia psittaci	
	Rickettsia prowazekii	
	Alphaviruses (Venezuelan equine encephalitis, eastern equine encephalitis, western equine encephalitis)	
	Epsilon toxin (from *Clostridium perfringens*)	
	Ricin (from *Ricinus communis* – castor bean)	
	Staphylococcus enterotoxin B	

Review Article

AN OVERVIEW OF DRAFT OF ASSISTED REPRODUCTIVE BILL 2010.

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Abstract

Surrogacy refers to the process through which a woman intentionally becomes pregnant with a baby that she does not intend to keep. Rather, she is carrying the baby for its intended parents, usually because they are unable to do so because of psychosocial, physical or physiological reasons. Couples from all over the world come to India, as India has become a hub for surrogacy. The draft of assisted reproductive bill 2010 is ready to be put in parliament and is long awaited. Ironically this also does not define many things which are important and worth explaining and which were already lacking in the ART bill 2008.

Keywords: Surrogacy, assisted reproductive bill 2010, gestational surrogacy

Introduction

Surrogacy refers to a contract in which a woman carries a pregnancy "for" another couple. The last quarter of the 20th century has witnessed several major advances in reproductive medicine. One of the most widely publicised celebrated and, at that time, controversial medical landmarks in this area was the birth, in 1978, of the first human baby resulting from in vitro fertilization (IVF). Since then, IVF has become a routine and widely accepted treatment for infertility. However, IVF is but one of many procedures in the increasingly complex and sophisticated field of biomedicine known as assisted reproduction. Since1978, nearly one million babies have been born worldwide as the result of assisted reproductive technology (ART) of one form or another. It has been estimated that in some European countries up to five per cent of all births are now due to ART. It is commonly accepted that infertility affects more than 80 million people worldwide. In general, one in ten couples experiences primary or secondary infertility, but infertility rates vary amongst countries from less than 5% to more than 30%. Most of those who suffer from infertility live in developing countries where infertility services in general, and ART in particular, are not available. The use of ART to manage infertility is a contested issue in the context of the cause of the problem, the attitude to overpopulation and the availability of scarce health resources in developing countries. Even in developed countries, however, where infertility patients stand a better chance of receiving infertility treatment, access to ART is limited. The generally high cost of ART procedures and national policies regarding accessibility and reimbursement leave many infertile people without the option of treatment. Although peer and social pressures to have children vary from country to country, what remains common in all is the desperate need of infertile people to give birth to a healthy child. Many infertility consumer groups consider this to be a human right, based on the following note from the UN Declaration of Human Rights, Article 16.1 that Men and women of full age, without any limitation due to race, nationality or religion, have the right to marry and to found a family. International concerns about ART and its

social and ethical implications were raised at the 52nd World Health Assembly in 1999, which requested the World Health Organization (WHO) to review recent developments in the field of ART as well as their social and ethical implications. In response to this request, the WHO Department of Reproductive Health and Research convened a meeting on the medical, ethical and social aspects [5] of assisted reproduction on 17–21 September 2001. The same principles should apply to new medical procedures. In the field of assisted reproduction, surveillance presents the profession with new and different challenges, in terms of methodology and in terms of targets.

A woman can claim as her own her head, her hair, her hands, her arms, her upper body, her legs and her feet. She cannot claim the same right for the remaining area of her body, which appears to belong more to males of the society, moralists, politicians, lawyers and others. The paternalistic attitude towards women restricts their reproductive freedom in natural reproduction. Women in need of assisted reproduction are even more subject to paternalistic subjective decisions. There are social, cultural and family pressures that impinge on couples (who can afford it) to use advanced technology such as IVF, gamete intra fallopian transfer (GIFT) and intra-cytoplasmic sperm injection (ICSI). It has been suggested that some childless women go through procedures such as IVF repeatedly, although they are aware that it is invasive and has risks of physical and psychological damage. The repeated use of these technologies is also encouraged by physicians as it is commercial and profit-making. The ambiguity towards the experience with IVF cycles has been revealed by many studies. However, it is believed that IVF focuses exclusively on biological reproduction and curtails any potential for the redefinition of parenthood or infertility. In so doing, it reinforces the notion of the "natural" bond between a mother and her biological children as well as reinforces the idea that the only desirable structure of social relations between adults and young children is the nuclear family or indeed one's own biological children.

According to the Ministry of Health and Family Welfare in India, there are about 181 centres in India offering ART. A few centres also exist in the public sector. The mushrooming of private centres combined with the lack of public sector centres has created a situation of exploitation of helpless, childless couples. The first case of surrogate motherhood in the country, which received considerable media coverage in October 1997, has also brought the need for ART guidelines to the forefront. Recently ICMR [3] finalized ethical guidelines for ART, but how will they be implemented remains to be seen after it is put in the parliament. ART are very expensive and only a few can afford them. Recently, the ICMR suggested that besides preventive measures, it is essential to reduce the costs of ART so that all couples have access to them. It has also been suggested that as ART are expensive, the option of adoption should be offered and there should be a shift to preventive services.

In a recent report by the Permanent Bureau at the Hague Conference on Private International Law, commercial surrogacy has been banned in many countries. As The Hague Report notes, this has produced a booming business in transnational surrogacy. In India alone, reproductive tourism is a $400 to $500 million per year business. In addition to the monetary costs, there are human costs. Transnational surrogacy results in complex, and often conflicting, rules regarding basic family law issues of maternity, paternity, custody, visitation, and children's rights.

Commentators have further noted that surrogates incur even greater risks and burdens than those usually associated with pregnancy and childbirth. A gestational surrogate must have her menstrual cycles precisely matched to that of the egg donor, so that her womb is receptive to the fertilized egg just when it is ready to be implanted. This requires surrogates to ingest large doses of hormones, the long term effects of which are unknown.

The child's rights are to be respected and ensured without discrimination of any kind including birth or other status. It is essential that the child should be registered immediately after birth and shall have the right from birth to a name, the right to acquire a nationality, and, as far as possible, the right to know and be cared for by his or her parents. There are two difficulties with this

provision, both grounded in its presumptive incorporation of national law. If that law provides that a mother is the person giving birth, the child's status is unclear. If that law provides that a child born of surrogacy cannot acquire the nationality of her intending parties, similarly, the child may be in a precarious situation [1]. Either problem can be rectified by reforming domestic law or as proposed in the pending Indian legislation on surrogacy, by requiring the intending parents to prove, before entering into a surrogacy arrangement, that the resulting child will be granted citizenship in the state where her intending parents live, and that they, in fact, will be legally recognized as her parents in that state.

In India as assisted reproductive technology is becoming a major issue so the Ministry of external affairs releases circulars and one of the latest one is dated 9.7.2012 [3] where certain new rules are mentioned starting with that the couple who wants child through surrogacy should be married for minimum of 2 years. If the couple is from any other country it should have a letter from the country that it recognises surrogacy and the child born will be permitted in that country. Further it mentions that an undertaking will be produced by the couple for looking after the child, treatment to be done at the registered clinics and the agreement between parties to be submitted to the government agency. On 7.3.2013 reviewed the same and included that the ministry should be granting visas for 3 months.

If we compare the draft of assisted reproductive technology bill-2008 [2] and 2010 [4], in chapter no 1 of the 2010 proposed bill there are some new definitions like art bank, biological parents, commissioning parents, department of health research, an egg, foetal reduction, married couple, patients which was not there in 2008 bill.

In the chapter2 there is modification in the appointment of the chairman of the board who will be the secretary of Department of health and research from Government of India (in earlier bill the chairman was appointed by ministry of health and family welfare) and also regarding the member secretary of the board who will be a senior scientist having knowledge of assisted reproductive technology from Department of health and research. Under the judicial proceedings there is modification regarding jurisdiction and trying of the couples who do not abide by the framework rules and also that regarding the proceeding of the state board and will be treated as on par with judicial proceedings.

In the chapter 3 where procedures for registrations and complaints are entered the word research is not attached to embryo and now means that the state art board can register clinics involved in any kind of research on art.

In chapter 4 where duty of the assisted reproductive technology clinic was to keep accurate record of DNA fingerprint of individual or couples and the child born now stands deleted and now the record registry to be set up by the DHR.

Regarding the source, storage, handling and record keeping for gametes, embryos where the word gamete was used and now semen and oocyte is used and where word semen was used now art is written. In earlier bill eggs from one donor could have been shared between two recipients, provided 14 oocytes were retrieved from a recipient .In the present proposed bill the retrieval is 7 oocytes from each recipient. A new clause added is that all unused oocytes would be then appropriately preserved by the assisted reproductive technology clinic for use on the same recipient or given for research to a bonafide organisation. The donor gamete where it was to store for 10 years will only be for 5 years. The new thing which is added is if during the period of five years, one of the commissioning partners dies the surviving partner can use the embryo for her or for her partner provided an appropriate consent was taken earlier. Where it was earlier that the records were to be transferred to ICMR in case of untimely closer now the proposal is for DHR.

In chapter 6 regarding the rights and duties of donor the identity of the recipient shall not be made known to the donor. In regard to rights and duties of surrogacy where the age was kept between 21-45 years and now it has been reduced to 21-35 years. Where it was earlier that that the surrogate mother should not have received a blood transfusion now the word has been added that

even a blood product transfusion of less than 6 months makes the lady ineligible for the same. Further it is that the birth certificate will be having the name of individuals who are genetic parents. Another important thing added is that in case the foreign party seeking surrogacy fails to take delivery of the child born, the local guardian shall be taking the delivery of the child and can hand over the child to an adoption agency after one month of birth. The child will be given Indian citizenship. No Indian who is acting as a surrogate will be sent abroad for the same. The women who will be acting as surrogate will be duty bound not to indulge in any act which will harm the foetus or the child after birth until the child is handed over to the designated person. The commissioning parents will further ensure the surrogate mother is insured until the child is handed and till the time the surrogate mother is free of all health complications arising out of surrogacy. If a foreigner or couple seeks sperm or egg donation or surrogacy in India, the child even though born in India will not be an Indian citizen.

In chapter 8 regarding the offences and penalties the use of individual brokers or paid intermediaries to obtain gamete donors or surrogates shall be an offence , punishable by imprisonment for term which may extend for 3 years and fine which may be specified.

In chapter 9 regarding miscellaneous it is that the act shall be in addition to and not in derogation of the provisions of any other law, for the time being in force except for the following a) provisions made in section 13(6) of this act. b) In applicability made in section 20[9] and 26(13) of this act.

Recommendations

A set of rational and consistent policies to manage ART is required. There should be a focus on non-technological solutions such as preventive measures for infertility, adoption of children of all sexes, raising consciousness to reduce the social pressures for biological parenthood and on protesting against perverse uses of ART.

The definitions of terms commonly used in ART should be agreed upon between ART providers and national and international registries. Guidelines need to be developed for the establishment of national and international ART registries [5].

- National ART surveillance programmes should be developed. These programmes should include non-ART methods of treatment and IUI with ovarian hyper stimulation.
- ART registries should be linked, where possible, with national health registries.
- Regional and global systems for managing data on ART outcomes should be further developed to allow analysis of time trends, of geographical differences and to provide information on new ART procedures.
- The principal outcome statistic of ART results should be singleton and multiple live-birth rates per treatment cycle initiated.
- National and international data on twin and higher-order multiple pregnancy rates resulting from ART and other forms of infertility treatment should be published.
- ART statistics need to emphasize the birth rates of healthy infants as well as rates of malformations, neonatal morbidity and mortality, and abnormalities of pregnancy.
- Malformation rates should include those associated with abortion, stillbirth and live birth.
- Data on foetal reductions should be included in ART registries and the amount to be clearly written for a surrogate mother which can be released in a phased manner and the complications if arise needs to be anticipated and compensation to be given at the earliest possible time, without delaying the same.

Conflict of Interest

None Declared.

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Review Article

PRESENT STATUS OF EUTHANASIA IN INDIA FROM MEDICO-LEGAL PERSPECTIVE AN UPDATE

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Abstract

Debate on Euthanasia has been raging for more than half century around the world and it continues to raise important questions in medical ethics, moral theology, civil rights and liberty. For the first time in India, there was a serious in-depth discussion about it in Supreme Court which finally endorsed Passive Euthanasia with its landmark judgment in Aruna Shanbaug case. It gave straightforward guidelines that are to be followed whenever such a scenario arises in India which will be law until parliament passes legislation in this regard. The Law Commission of India has proposed a bill in this direction which is yet to be passed by the parliament. The present article discusses all these in detail to understand this complicated issue.

Keywords: Euthanasia, terminal illness, informed decision, parens patriae, competent

Introduction

"Marte hain aarzoo mein marne ki Maut aati hai par nahin aati" Mirza Ghalib (A famous Urdu poet)

"I'm not afraid of being dead. I'm just afraid of what you might have to go through to get there."

— Pamela Bone (A reputed Journalist)

These two quotes give us a fair idea about the fact that sometimes people with terminal illness would rather like to embrace death 'peacefully' than clinging on to life filled with intractable pain and suffering.

Euthanasia is described as the deliberate and intentional killing of a person for the benefit of that person in order to relieve him from pain and suffering. The term 'Euthanasia' is derived from the Greek words which literally means "good death" (Eu= Good; Thanatos=Death). The term was coined by the great historian Suetonius, who described the way King Augustus opted for quick, painful death without suffering [1]. According to Oxford English dictionary Euthanasia means, the painless killing of a patient suffering from an incurable and painful disease or a person who is in irreversible coma [2]. According to the British House of Lords Select Committee on Medical Ethics, it is defined as "a deliberate intervention undertaken with the express intention of ending a life, to relieve intractable suffering" [3].

Euthanasia can be categorized into two types- active and passive

(a)Active Euthanasia- When a person directly and deliberately does something which results in the death of patient. Here specific steps/procedures are undertaken (by the third party) like the administration of a lethal drug. This is a crime in India (and in most parts of the world) under the Indian Penal Code section 302 or 304 [4]. There are countries which have passed legislation permitting assisted suicide and active euthanasia. The differences between them are in the former, patient himself administers lethal medications and in the later doctor or

some other person does it. In Netherlands, euthanasia is sanctioned by the passage of "Termination of Life on Request and Assisted Suicide (Review Procedures) Act" 2002 providing well defined guidelines for the same [5]. Belgium was the second nation to take a stand in this direction [6]. In Switzerland assisted suicide can be performed by non-physicians [7]. Both Active Euthanasia and Assisted Suicide are legal in Luxembourg since 19th February 2008. Apart from these handfuls of nations, none in Europe have legalized Active Euthanasia or Assisted Suicide. In USA, active euthanasia is a criminal offence except in the states of Oregon [9], Washington [10] and Montana [11] where strict guidelines are in place. It is important to mention that the state of Michigan banned euthanasia and assisted suicide after Dr. Kevorkian (infamously known as 'Doctor Death') recklessly encouraged and assisted in suicides [12].

(b) Passive Euthanasia-It involves withholding of medical treatment or withdrawal from life support system for continuance of life (like removing the heart–lung machine from a patient in coma). Hence in passive euthanasia death is brought about by an act of omission.

Euthanasia can be further classified as 'voluntary' where euthanasia is carried out at the request of the patient and 'non-voluntary' where the person is unable to ask for euthanasia (perhaps because he is unconscious or otherwise unable to communicate), or to make a meaningful choice between living and dying and a surrogate person takes the decision on his behalf. Legally speaking voluntary euthanasia is illegal as it can be interpreted as attempt to commit suicide which is punishable under Indian Penal Code section 309 [13]. The same was advocated by the judgment from the Constitution Bench of the Apex Court in the year 1996 in Gian Kaur vs. State of Punjab where it stated that the right to life guaranteed by Article 21 of the Constitution does not include the right to die [14]. Notwithstanding these legal predicaments, passive euthanasia is not illegal in most parts of the world including India; provided certain standard safeguards are present as demonstrated by Supreme Court in Aruna Shanbaug case, which we will be discussing here.

To put things into right perspective let us ask ourselves a simple question, what is the need of Euthanasia?

Before the industrial and scientific revolution, the scientists had not invented the artificial ways of keeping a terminally ill patient alive, like ventilators, heart lung machines, artificial feeding, etc. Such patients would have naturally died during the ordinary course of nature. With the scientific revolution, there was better and in-depth understanding of the human body. Simultaneously there was advent of new technology and machines, through which it is possible to prolong the life. Even though the patients are kept alive, often they will be in extreme physical pain and suffering (emotional, social and financial). At this stage let's reiterate that these advanced intensive care procedures which we are referring here, will by no means cure/control the disease, but it will only prolong the agony as well as existence of terminally ill patients.

Next logical question will be when can we classify a patient as terminally ill?

According to The Medical Treatment of Terminally ill patients (Protection of Patients and Medical Practitioners) Bill 2006, 'terminal illness' means – (i) such illness, injury or degeneration of physical or mental condition which is causing extreme pain and suffering to the patients and which, according to reasonable medical opinion, will inevitably cause the untimely death of the patient concerned, or (ii) which has caused a 'persistent and irreversible vegetative' condition under which no meaningful existence of life is possible for the patient. Thus according to it, the patient must be suffering some ailment causing extreme pain and suffering, which according to equitable and unbiased medical opinion, will lead to his death sooner or later. Second scenario is when the patient has slipped into Irreversible Permanent Vegetative State.

These patients without active lifesaving mechanisms or life prolonging procedures will die a natural death. Thus one would like to ask would it be reasonable to simply keep the patient alive if he is suffering from intractable pain, psychological and emotional distress just for the sake of keeping

him alive. If we widen the ambit of discussion, can we ignore the impact on his family/friends? What about their socio economic problems? their emotional sufferings? And in a place like India where most of its citizens meet their health expenses from their own pockets, continuing such expensive treatments results in considerable financial burden on poor households, often pushing them deeper into poverty. Even if the patient is having medical insurance it is usually inadequate. Poignantly our government health sector spending is perilously inadequate and is over burdened by huge population putting strain on the limited government resources. The WHO Report mentioned that in India about 87% of total health expenditure is from private spending, out of this, 84.6% is out-of-pocket expenditure15. The World Bank in its annual report in the year 2002 came up with some other startling observations that more than 40% individuals who are hospitalized in India in a year borrow money or sell assets to cover the cost of health care as well as hospitalized Indians spend more than half of their total annual expenditure on health care16. Thus one cannot disagree from the fact that there is genuine need for Passive Euthanasia with definitive, unbiased protocols and safeguards.

Now we shall discuss two important judgments: Airedale case from the House of Lords, UK and Aruna Shanbaug case from Supreme Court of India giving us a fair idea regarding the evolution of the laws pertaining to Passive Euthanasia in India and the world.

1. Brief facts about Airedale NHS Trust vs. Bland case:17

Tony Bland was injured in Hillsborough stadium, Sheffield, England on 15th April 1989 in a terrible tragedy occurred during a football match. The crush resulted in the immediate death of 94 spectators and injured another 76618. Tony Bland suffered serious injuries in the form of multiple ribs fractures and two punctured lungs, causing disruption in the supply of oxygen to his brain leading to irrevocable damage to the higher centers of the brain leading to Persistent Vegetative State19. He was transferred to Airedale General Hospital. Neuro-radiological investigations showed that there was no cortical activity but his brain stem remained largely intact. His family considered him as dead and medically it was proven that there is no possibility of him emerging out of the coma.

In August 1989, Dr. Jim Howe the Neurologist who was treating Tony Bland contacted the Sheffield Coroner to withdraw all treatment including artificial nutrition and hydration after undertaking comprehensive consultation with the family and in agreement with their wishes. Next day Dr. Howe was visited by the Police who told him that if he 'withdrew treatment and if Tony dies, that he would be charged with murder'.20 Then Airedale NHS Trust with the support of Tony Bland's family and Dr. Howe made an application to the court to grant permission to withdraw all life-prolonging treatment. This went on to become a milestone case as Airedale NHS Trust vs. Bland 1993. All the learned judges in the House of Lords unanimously agreed that Tony Bland must be allowed to die and passed the judgment on February 4th 1993. Mr. Bland's parents supported the doctors' court action and said they were "relieved" at the ruling. His life support machine was switched off on 22 February and he died on 3 March. In April 1994 the High Court rejected an attempt by a pro-life campaigner, Father James Morrow, to get the doctor who withdrew food and drugs from Tony Bland charged with murder.

This was a benchmark case which influenced similar petitions throughout the world. In India passive euthanasia was deliberated in Supreme Court in case, Aruna Ramachandra Shanbaug vs. Union of India (2011).21

2. Brief facts about the Aruna Shanbaug case:

Miss Aruna Shanbaug was working as Junior Nurse in King Edward Memorial (KEM) Hospital, Mumbai, where in the year 1973, she was sexually assaulted by a ward boy. He strangulated her with a dog chain and sodomized her22. The resultant asphyxiation caused irreversible injury to the brain causing Permanent Hypoxic Ischemic damage to her brain and since then, she has been in a persistent vegetative state. After some time her family abandoned her, but the nurses at the KEM hospital continued to take care of her. On 17th December 2010, Pinki Virani claiming to be Aruna's friend (a social activist-cum-journalist) made a plea in Supreme Court

for permitting euthanasia on Aruna Shanbaug. The Honorable Supreme Court sought a report about Shanbaug's medical condition from the Govt. of Maharastra. Three member Expert Committee subsequently examined and opined that she was in a Permanent Vegetative state.21

On 7th March 2011, the Apex Court, while rejecting Pinki Virani's plea for active euthanasia, the court observed that "the general legal position all over the world seems to be that while active euthanasia is illegal unless there is legislation permitting it, passive euthanasia is legal even without legislation provided certain conditions and safeguards are maintained". The court also formulated guidelines for the passive euthanasia23. This is important in a country like India with its vast and culturally diverse population where unfortunately the ethical standards of our society have descended to new low (as evidenced by social evil like rampant sex selective abortions, honor killings, gang rapes etc.); there is an impending possibility that people might misuse passive euthanasia in order to inherit the property etc.

Basic Guidelines issued by the Hon'ble Court for Passive Euthanasia:

Whenever there is a need for passive euthanasia for some patient, permission has to be obtained by the concerned High Court before life prolonging measures can be withheld. Here the court will act as 'parens patriae', a doctrine that grants the inherent power and authority of the state to protect persons who are legally unable to act on their own behalf.24 The idea behind parens patriae (father of the country) is that the King as the father of nation has a sacred duty to take care of those who are unable to look after themselves. This is essential as in most cases where the question of passive euthanasia arrives; the patients are often unconscious or otherwise unable to communicate their intensions. Thus in order to prevent any sort of criminality by the patient's relatives/friends or even treating doctors, courts will oversee and take the decision on behalf of the patient. It is ultimately for the Courts to decide, as to what is in the best interest of the patient, though the wishes of close relatives and next friend, and opinion of medical practitioners should be given due weightage in formulating the decision. Hon'ble Court also laid down procedure to obtain such permission in detail.25

It also appreciated the entire staff of KEM Hospital, Mumbai (including the retired staff) for their noble spirit and outstanding, exemplary and unprecedented dedication in taking care of Aruna for so many long years. Having never developed a single pressure sore or fracture, in spite of the fact that she was bedridden for almost three and half decades is the standard testimonial of the same. It also opined that KEM hospital staff members are her 'true friends' and not Ms. Pinki Virani who has only visited her on few occasions and written a book on her. Hence the decision to withhold life prolonging measures rests on the hospital staff and not Ms. Pinki Virani. KEM staff members have expressed their wish that Aruna Shanbaug should be allowed to live. However in future if they change their mind, they will have to follow this procedure established by the Hon'ble Apex Court.

On 20th April, 2011 Union Law ministry taking note of this important judgment and guidelines (pro-tempore) wrote a letter to the 19th Law Commission to give a report on feasibility of making legislation on euthanasia. On 11th August 2011, Law Commission submitted their report to Government of India titled 'Passive Euthanasia- A Relook'.26 In the modified and revised Bill proposed by 19th Law Commission, the procedures laid down are in line with the directions of the Supreme Court in Aruna Ramachandra case. Salient features of these are as follows:

- '**Best interests**' include the best interests of a patient : (i) who is an incompetent patient, or (ii) who is a competent patient but who has not taken an informed decision, and are not limited to medical interests of the patient but include ethical, social, moral, emotional and other welfare considerations.
- '**Incompetent patient**' means a patient who is a minor below the age of 18 years or person of unsound mind or a patient who is unable to –
  (i) understand the information relevant to an informed

decision about his or her medical treatment;

(ii) retain that information;

(iii) use or weigh that information as part of the process of making his or her informed decision;

(iv) make an informed decision because of impairment or a disturbance in the functioning of his or her mind or brain; or

(v) Communicate his or her informed decision (whether by speech, sign, language or any other mode) as to medical treatment.

- '**Competent patien**t' means a patient who is not an incompetent patient.
- '**Informed decision'** means the decision as to continuance or withholding or withdrawing medical treatment taken by a patient who is competent and who is, or has been informed about-
  - (i) the nature of his or her illness,
  - (ii) any alternative form of treatment that may be available,
  - (iii) the consequences of those forms of treatment, and
  - (iv) the consequences of remaining untreated.

A competent adult patient has the right to insist that there should be no invasive medical treatment by way of artificial life sustaining measures / treatment and such decision is binding on the doctors/hospital attending on such patient provided that the doctor is satisfied that the patient has taken an 'informed decision' based on free exercise of his or her will. The same rule will apply to a minor above 16 years of age who has expressed his or her wish not to have such treatment provided the consent has been given by the major spouse and one of the parents of such minor patient. This is in accordance with the three paramount principles in medical ethics which are patient autonomy, beneficence and Non-maleficence.27,28,29

Thus in case of any incompetent patient who is in irreversible coma or in Permanent Vegetative State and a competent patient who has not taken an 'informed decision', the relatives, next friend, or the doctors concerned/hospital management shall get the clearance from the High Court for withdrawing or withholding the life sustaining treatment. The High Court shall take a decision after obtaining the opinion of a panel of three medical experts and after ascertaining the wishes of the relatives of the patient. As "parens patriae" the High Court will take an appropriate decision having regard to the best interests of the patient. Provisions are introduced for protection of medical practitioners and others who act according to the wishes of the competent patient or the order of the High Court from criminal or civil action. Further, a competent patient (who is terminally ill) refusing medical treatment shall not be deemed to be guilty of any offence under any law.

This Bill has to pass through various stages before it becomes an Act. Until then the law laid down by Hon'ble Apex Court is to be followed whenever need for Passive Euthanasia arises in our country.

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Ethical clearance: Not applicable

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