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THE EPIDEMIOLOGICAL STUDY OF DOWRY DEATH CASES WITH SPECIAL REFERENCE TO BURNT CASES IN ALLAHABAD ZONE (Chapter 2)

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REVIEW OF LITERATURE

Dowry, a monstrous social evil, widely prevalent mostly amongst Hindus of upper and middle classes of Northern India, is the prime factor for unnatural deaths in newly married females where the victims are tortured for few gold coins to such an extent that no option is left except to end their unhappy life. Besides dowry, illiteracy, arranged or love marriages, child marriages, joint family structure, oedipal dominance of mother-in-law, unemployment and economic dependence of husbands on their parents, near complete dependence of women or their husband and / or in-laws, drunkenness, cruelty and infidelity of the husbands and want of social security among Hindu women are other contributory factors affecting the marital happiness in one or other ways (Das Gupta and Tripathi; 1984).

Chronic incurable diseases, inability to bear a child, sexual jealousy and marital infidelity in married females and failure in love and / or illicit pregnancy and scolding by parents of unmarried girls are the reasons behind unnatural female deaths.

To a forensic expert analysing the dowry deaths is an important duty from the investigating agency a starting point for their inquires and allows them to deal more efficiently because any unnatural death may be suicidal, accidental or homicidal. It is the responsibility of the investigating agency to establish whether the case is suicidal, accidental or homicidal, and in the case of last category whether it amounts to murder or not because an alleged homicidal death may or may not amount to murder depending on the facts and circumstances of the case. In the same manner, a suicidal death of young married woman is likely to be registered as a dowry death case because of motives of suicide are due to acts of dowry.

There are unusual difficulties in ascertaining the nature of death particularly when good amount of planning has gone into the preparation of crime and when perpetrators have sufficient opportunity to destroy the evidences. For analysing in proper manner, the dowry death cases can be broadly grouped as below:-
(A) Death due to burn
(B) Death due to asphyxia

(I) Drowning
(ii) Hanging
(iii) Strangulation
(iv) Throttling
(v) Smothering etc.
(C) Death due to poisoning
(D) Death due to other causes.

BURNING

In cases of burning, the usual explanation given for such death is that the woman caught a fire accidentally while cooking a meal or preparing tea or snacks. Some times a woman's death is attributed to other accidents such as a lighted lamp falling on her during night or stove catching fire or an oil explosion in a stove. Rarely such a death is attributed to suicide or homicide.

In suicidal cases a person , intending to commit suicide may indulge in certain acts like sprinkling of kerosene, writing a suicide-note, bolting the door from inside etc to make the attempt successful. The victim can also be killed by burning. Therefore, the facts and circumstances of the case are very important to establish nature of crime and category of culpability. After the burning of bride, any evidence of harassment or cruelty left by her within house-hold is also destroyed. Police too is handicapped as most important clues at the scene of occurrence might also be destroyed intentionally. Both family members and neighbors are usually non-cooperative due to police involvement. In many cases even dead body of victim is not available as the culprits dispose off the body by cremation without informing the police or the deceased relatives. It is indeed a very well planned crime committed within the four walls of house. It is a common knowledge that relatives and the police under report such incidents in which young women prefer to end their lives rather than suffer prolonged torture and ill treatment at the hands of their in-laws and /or husbands.

(A) CONCEPT OF BURN

The Webster's dictionary defines "burns" as an injury caused by heat, abnormal cold, chemicals, poison, electricity or lightening and is characterized by reddening (Ist degree), blistering (2nd degree) or charring (3rd degree).

Medico legally a burn is a lesion which is caused by application of heat or chemical substance to the external or internal surface of the body, which causes destruction of tissues. The other synonymous terms used in relation to burns are also defined viz- " Surge'-superficial burning that takes off ends or projections (to single hair); Scorch- superficial burning usually resulting in change of colour because of shrivelling or curling; Eschar - drying or hardening by heat". At present stress will be laid mainly on burns by heat i.e. by flames, hot liquids or gases, even heated objects and the likes; as these are the contentious issues featuring in "dowry deaths" in India after a fashion, destruction of evidence of assault / homicide by lighting the body and the surroundings etc.

(B) CLASSIFICATION OF BURNS

Indian forensic literature has been at logger heads with the established clinical standard methods of assessment of extent of burns, as they still describe archaic descriptions by Dupuytren of impractical consideration when quantifying and prognostically assessing burns in six grades or degrees:

(i) First degree burn shows erythema.
(ii) Second degree burn is characterized by vesication.
(iii) Third degree burn involves destruction of superficial layer of skin.
(iv) Fourth degree burn shows total destruction of true layer of skin.
(v) Fifth degree burn is characterized by involvement of subcutaneous tissue, deep fascia and muscles.
(iv) Sixth degree burn includes destruction of blood vessels, nerves, serous cavities, bones etc.

On the other hand even Wilsons's criteria i.e. (1) epidermal (Dupuytren's first and second degrees) (2) dermo-epidermal (third and fourth degrees) and (3) deep burns (fifth and sixth degrees) for delineating extent of superficial burns are not followed by clinicians treating burn patients with the result that the physician's assessment varies with the forensic assessment of the extent of injury (Tiwari, et al; 1993). The clinical percepts of burns extent /depth assessment have been well reiterated by our forensic authors abroad. (Bernard Knight ; 1990). To restate categorically the universally practised method of classifying of burns, based on Culled Forensic and Clinical Literature:

(i) First degree burn:

Outer layer of skin is involved with predominant vascular reaction as dilatation of arterioles and capillaries resulting in reddening of skin. Blisters do not form but the skin is red swollen and painful.

(ii) Second degree burn:

Result in detachment of epidermis from dermis. It typically shows blistering with upper layers destroyed or dying epidermis evident, sometimes with central necrotic area surrounded by zone of hyperaemia or blister formation.

(iii) Third degree burn:

Involves the entire thickness of skin epidermis and dermis with massive necrosis with stiffened yellowish brown and leathery areas with prominent or dried blood vessels in its floor.

Spitz (1980) stated fourth degree burn for more severe thermal injury resulting in charring of the body surface with destruction of skin and underlying tissues such as muscle and even bone.

(C) QUANTITIFICATION OF BURN AND PROGNOSIS

Wallace (1951) stated that to determine the extent of burn on the body surface, the easiest and most popular method followed universally for adult human body surface is the "Rule of nine" defined by Pulaski and Tennison in 1947, where the area of that person's palm area represents 1% of the body surface. In children, since the head is larger compared to lower limbs, the method of computation instead is:

% Total body surface area of child's head and neck = 9 +(12- age)
% Total body surface area of child's lower limbs = 41 - (12- age)

Lynch and Bolcker (1963) have differentiated between infants for whom they described the head, front and back of trunk all to represent 20% of the total body surface area, while each upper limb is

10% ; when assessing children, they modified the formula : Head, lower limbs and posterior trunk is 15% total body surface area, the anterior trunk 20% and the upper limbs each rated 10% total body surface area. Detailed charts by Lund and Browder (1944) as well as computerised calibrated system devised for the emergency by Scott-Canner et al for clinical assessment scenario have found little favour or of practical utility in our country. The prognosis of survival after sustenance of burns depends upon the age of the victim, the physical health at the time of injury, the percentage of burns and the treatment given. Young children with good treatment may recover from 50% to 60% 2nd degree burns. Victim above forty years of age are unlikely to recover from even 40% of burns, while in old age even 10% burns may prove to be fatal (Cameron; 1974).

(D) ORGANOPATHOLOGY OF BURNS

Respiratory tract:

In victims of fire in buildings where there is considerable production of smoke, soot may be found embedded in a film of mucous over the tongue, fauces, larynx and trachea; along with latter becoming inflamed. If very hot gases are inhaled, these mucosa may be blistered or shredded, and the larynx oedematous. Not uncommonly, the victim who inhales smoke also vomits and inhales some of the vomitus, presumably between bouts of coughing, and plugs of regurgitated stomach contents mixed with soot may be found in smaller bronchi in the depths of lung. Obstructive oedema, laryngospasm, tracheo-bronchitis, patch areas of pneumonia, pulmonary congestion and oedema with carbon pigment in alveolar phagocytes especially in burns in closed confined spaces are the usual findings (Mant, Kieth; 1982).

Kidney:

Thermal injury does not directly affect the kidneys but the basic picture of shock is seen and nephromegaly is also seen. (Teplitz; 1969). The intrarenal obstruction results in micro-circulatory insufficiency and renal ischaemia. Haem casts in medullary area suggest acute tubular necrosis (Goodpastor et al; 1946 and Haynes et al; 1951).

Gastrointestinal tract:

Acute ulcers (Curling's ulcers) have been reported in burn cases not only in the duodenum but also in the stomach. These ulcers are not found within a day of injury or when the burn less than 10%. Analysis indicated that the burn is and gastric ulcers occurred either early i.e. during first week or later specially third or fourth week (Sevitt; 1957).

Adrenals:

Adrenals in burn cases show increased functional activity with increased size along with lipid depletion and cortical or medullary sinusoidal congestion the latter, on autolysis simulating adrenal hemorrhage. Hemorrhage either massive or bilateral, if observed, has arisen most likely from fulminant sepsis of gram negative bacteria, when fibrin thrombi may be demonstrated in the sinusoids (Weiskotten; 1917).

Brain:

The brain as a general rule escapes injury; if oedema, congestion, signs of raised intracranial tension including herniation of cerebellar tonsils are seen then these may be secondary to water and electrolyte imbalance (Gibson; 1945 and Walker & Shenkin; 1954). However, metastatic cerebral microabscesses and haematogenous meningitis have been reported with burn sepsis. Of the neurons, only the Purkinje cells show occasional general degenerative changes. An identification feature described on histology of the Negro brain is grey deposit of melanin in area of olfactory nerve as well as base of frontal lobes(Spitz; 1980).

Heart:

The heart may show nonspecific septicaemia, metastatic septic foci in the myocardium or endocardium, interstitial oedema and even myocardial fibre fragmentation. Many of these changes are progressive changes, associated with some minimal survival after burns(Walker an Shenkin; 1954).

Musculoskeletal system:

Late effects have been reported in somewhat prolonged survival after burns in the musculoskeletal system in the form of pathological fractures, joint dislocation from faulty positioning, especially of the joint fixation or ankylosis. Early epiphyseal closure in the young, retarded limb growth and conversely in some accelerated limb growth with disparity in length of limbs have been reported (Evans; 1969).

Skull Fractures:

Fractures of the skull and intracranial hemorrhages are often found in charred bodies. They may arise due to (i) Injuries due to antemortem violence (ii) Action of heat on skull and its contents (iii) Injuries to the body after death.

Implosive fractures may be as a result, previous felonious assault or homicide or from structural (building) collapse. Moritz (1988) stated that skull fractures from thermal injury could be of two types:

(a) Explosive fractures from increased intracranial pressure which displaces the contents outwards.

(b) Desiccation and shrinkage of the outer table which may result in stellate fractures and fragmentation of the outer table. This is considered to the natural consequence of fire, where extreme heat causes fluids in and around the brain to expand and boil, with the resulting steam causing explosive reaction.

Post-mortem fractures are reported to first appear as cracks outside the skull in the temples, sometime bilaterally, as several lines radiating from a common centre - with subsequent outpouring of the brain matter when the steam pressure within is markedly increased. While some authors have described explosive fractures of the head to occur along suture lines with explosion of brain matter in a circular pattern around the head, more often in children around the fontanelles, as logically from suture or diploe separation. Spitz is categoric in his observation that curiously post-mortem heat fractures of the skull do not involve the diploe of the skull even in young

individuals with open sutures, and also that these fractures do not cross suture lines. It is however correct to remember that such explosive appearance has to be differentiated from antemortem gun shot wounds. The best means of differentiating is by microscope evidence of tissue reaction at the margin of the fractured bone, which is only seen if the victim survives about an hour or more (Gordon, et al; 1988).

(E) CELLULAR AND TISSUE CHANGES IN BURNS:

At degrees of burns short of actual charring, the effect of heat on the tissues is to fix them by coagulation of protein so that the cell outline become indistinct and the tissues take up histological stains more intensely (Mant, Kieth; 1982).

In the epidermis, heat causes separation of the epidermis from the dermis to form blisters. In the process of blister formation, the cells in the deeper layers of the epidermis from dermis , becomes elongated, with their long axis tending to be oriented more of right angles to the skin surface, closely resembling the "streaming" of epithelial cells (Jellinek; 1951).

Sevitt (1949) observed that reduction in rate of blood flow at the site of burn followed by stagnation and intraluminal agglutination of RBCs in arterioles, venules and capillaries. In his opinion, necrosis associated with severe thermal injury arises from direct heat effect on the exposed tissues and concurrent stasis of blood flow leading to stagnant anoxia and complete sloughing of the overlying skin. When epithelial tissues in the interior of the body, notably the lining of air passages are exposed to heat, the cell are liable first to become swollen, pale and ballooned. However, they are then relatively rapidly shed into the lumen of the viscus. Thus, the smaller peripheral air passages are liable to become choked by a mass of desquamated epithelial cells, mucus and carbon particles (Pullar; 1973).

(F) TOXIC FUMES INHALATION:

These cases, also known as "smoke inhalation syndrome" get clubbed with thermal injury cases since they are commonly found at the scene of the fire. Modern furnishings and structural components are increasingly being made from polyurethane, polystyrene, polyvinyl and other plastic materials. While differences in the degree of ignitability exist amongst them, these disappear when the ignition source increase (Palmer and Taylor; 1974). On burning, these material release gases of medico legal importance other than carbon dioxide such as carbon monoxide, hydrocyanic or prussic acid and oxides of sulphur and nitrogen. In estimating cyanide, it should be remembered that stored, even if refrigerated, could produce large quantities of cyanide after death if stored for few days; ideally, it should be estimated afresh (Curry, et al; 1967). Significant quantities of cyanide on the other hand , is an important finding, indicating death from hydrocyanic acid asphyxiation (Ballantyne; 1977 and Wetherall; 1966). This will be associated with bright red colour (Cyan haemoglobin) of blood.

Whitehead (1960) stated that these gases can be simply detected by spectroscopic examination of fresh post mortem blood; which should be a part of the normal autopsy protocol especially in burn cases. Semiquantitative assay by the method of Whitehead and Worthington or by ultraviolet spectroscopy should complement findings noted on autopsy table to rule out smoke inhalation syndrome. If, however, it is not possible to analyse the blood immediately, it should be refrigerated carbon monoxide results in a pinkish colour to arterial blood and a dark pinkish / purplish hue to

venous blood. Tissues and organs give a cherry-pinkish hue of carboxyhaemoglobin. A chocolate colour is seen in asphyxiation from fumes of oxides of nitrogen and sulphur in this staining.

The characteristic biphasic distribution of carboxyhaemoglobin in fire victims together with other observations suggest that the principal cause of death is carbon monoxide followed by carbon dioxide poisoning and or oxygen deficiency, while the infuence of heat is considered to be of minor importance (Gormsen et al; 1984).

Goodball, et al (1957) reported a greatly increased catecholamines excretion in the seriously burned patients. This shows that catecholamines will stimulate oxygen consumption. This study revealed that increased oxygen consumption and catecholamines excretion occur simultaneously in seriously burned patients. According to Knight (1991), in an unburnt dead body recovered from the site of a fire where a complex combination of the above gases have been detected the cause of death is "inhalation of smoke".

(G) INFECTION:

With passage of time after substainance of topical burns bacterial colonisation begins, first on the surface of the wounds (supra- escharcolonization), within the pit of destroyed hair (intrafollicular colonization) or within heat coagulated dermis and subadjacent hypodermal fat (Intraeschar colonization). When the bacterial growth extends in subadjacent tissues, terms such as invasion / burn wound sepsis / burn wound infection are used (Artz and Moncrief; 1969). For the first two days, the burn's surface is generally sterile. Then bacterial colonization begins, surface down to the depth of eschar, pus seen in the burn heralds wound sepsis, while septicaemia arises from systemic dissemination of bacteria with metastatic visceral lesions. Most common cause of death due to burns is infection. It may be bacterial by pseudomonas proliferation, fungal or viral. Normal skin flora is greatly reduced at the time of injury. Patterns of bacterial and fungal colonization are related, in part to the topical or systemic antibiotic used for the prophylaxis of infection and vary with the area burnt. Burns of the legs are contaminated usually by the enteric flora, more frequently than other areas. Environmental factors also play role e.g. colonisation by pseudomonas has occurred in some military personnel burned in jungles of Vietnam where meliodosis is endemic and where that organism is a common soil and water contaminant.

Escharotomy incisions, superficial veins and burned areas involving cartilage, are more prone to infection. The superficial cutaneous veins of burn wound represent a strategic route whereby focal invasion may quickly lead to disseminated sepsis. Infective phlebitis due to direct vascular invasion of burn wound has been seen with pseudomonas and fungi. Cannulated veins beneath adjacent to the burn wound are more prone to infection, as compared to cannulated veins of unburned areas. Bacterial chondritis is a frequent infective complication of burns of ears and less commonly, in thoracic involvement.

Streptococcal and staphylococcal infections are now exceeded by gram negative infection e.g. pseudomonas, proteus, escherichia species and other coliforms. The diagnosis may be suspected when hemorrhagic discoloration occurs in or around the burn wound. Biopsy of this area shows invasion of necrotic hemorrhage tissue by scores of bacilli. The necrotic and hemorrhage character of lesion is attributed to vascular, and the effects of bacterial endotoxins.

The infection of skin appendages in second degree burn may convert the wound to one of full thickness cutaneous necrosis. Fraenkel described the specificity of the tissue diagnosis of pseudomonas infection, is a characteristic typical colonisation of the bacilli in the wall's of blood

vessels. In cases of infection by fungi, earliest gross findings would be a hemorrhage area of discoloration in burn wound, which may be mistaken for post - traumatic ecchymosis.

Monster A.M. (1970) observed that infection continues to be leading cause of death in cases of burns, one of the important cause of infection was observed as lowered levels of immunoglobulin after the burn injury. Manster experimented and noted that in first few hours after thermal injury serum gamma globulin concentrations were normal but thereafter rapidly falls to a maximum levels of depression at 48 hours. This fall is said to be due to mechanical leakage from the burn wound.

(H) CAUSE OF DEATH IN BURNS:

Death from burns within the first 24 hours is usually due to hypovolumic shock or smoke inhalation syndrome. These causes also account for death in the next 2-3 days. While toxaemia also plays a role beyond two days of survival, the death arising there of is due to shock. In the later periods beyond this, sepsis is the most important cause of death. Death may also occur indirectly from bronchopneumonia, especially in infants. Significant hemorrhages from acute gastric erosions of gastro duodenal tract can also be a contributing factor in delayed deaths from burns. Fatal renal shutdown may occur either directly as a result of burn shock or sepsis.

Bangal, et al; (1995) observed that septicemia and acute renal failure are found to be responsible for majority of death, shock, respiratory burn and bronchopneumonia being other main causes. This findings is in agreement with the observation of majority of workers including Sevitt (1957), Teplitz (1965), Foley et al (1968) etc. However Philips et al (1962) and Munster (1990) both found the principal killer in cases of burns to be respiratory tract damage either alone or in combination with other causes.

Death from electric burns may be instantaneous or it may be delayed for several hours. In electric burns, death can be due to extensive external thermal burns or it may result without any significant surface involvement. Barrera (1944) concluded that all rapid deaths are due to either cardiac failure or respiratory failure. Alexander (1948) has stated that these cardiac arrests are most likely due to an intense stimulation of the nerve centers in the medulla oblongata.

(I) DURATION OF BURNING:

This is a very conjectural subject as the exact conditions available at the scene of crime can at best be guessed at. There is no universally acceptable criteria to determine duration of burn. Richards has suggested some points in delineating the time involved. A clothed body is destroyed in fire more rapidly and completely than an unclothed one, and an obese body consumed more time than a lean one. In a ravaging house fire, a body is charred in less than twenty minutes whereas timber is charred to only half its depth in the same duration. (Richards; 1977)

Svensson and wendel (1955) stated that a child's body of five days life, for instance, may be reduced to a few ounces of ashes in relatively short time, which would be insufficient to affect an adult human body, and can be burnt away in an ordinary slow burner/oven in less than two hours.

Tedeschi (1977) reported that the outdoor cremations in orthodox Hindu pyres by the side of the Ganges burning for three days followed by raking of the ashes reveal large pieces of bone still recognizable. It gives an idea of the difficulty of completely destroying the human body.

(J) THE HUMAN BODY AND BURNS:

According to Gee (1974), death usually takes place in a conflagration long before a fire is brought under control. The extensive mutilation frequently seen in victims of fire largely occur after death. Charring is quite common. While surface destruction may be extensive, organs are usually still preserved for a meaningful and subsequent chemical analysis for carbon monoxide and alcohol. In oxygen enriched atmospheres flames may "flash over" the surface of the body and clothings with superficial burns resulting all over. These clothings saturated with oxygen becomes highly inflammable.

Denison et al (1968) reported that the human skin and flesh are almost non-inflammable in air at normal pressure and in pure oxygen ignite with difficulty; although once ignited they burn vigorously. However, human hair is readily flammable in air, as well as in oxygen and material such as denim, velvet and brushed nylon are also highly flammable in atmospheres rich in oxygen and a pile of these can actually propagate the fire. If these are burnt in very high concentrations of oxygen, they will show the effect of very rapid flash fire. From animal experiments, they have surmised that in higher concentrations of oxygen, a man wearing denims will invariably suffer deep burns to at least half his body surface before he could take preventive action. Fire from combustible agents such as polyurethane foam etc. which ignite very easily and burn very violently result in very rapid spreading of fires, and heat is so intense that several persons are injured. The air preceding the flames may be sufficiently hot to ignite the hair and cloths of fleeing persons.

Human fat, unlike skin and flesh, has on the other hand shown through experiments that, when melted, will soak into fabric which will act as a wick. A temperature of about 250^0C is necessary to melt the fat, but once melted, it will soak into cloth and burn as a wick in a lamp even when the temperature of the fat has fallen as low as 24^0C . In fact, this is the explanation quoted of Dr. J.B. Firth of the Home Office Forensic Science Laboratories, Great Britain, in English literature (Mant, Kieth; 1982).

Spitz (1980) stated that the skin of a child is more sensitive to heat injury than an adult, while mucus membranes of the mouth and throat are more resistant, the skin of the palms is more resistant to heat than that on face, abdomen and genitalia.

Regarding hair, it has been noted that light colored hair, change colour on exposure to heat by 121^0C, their colour would have turned to grey and by ten to fifteen minutes exposure of 205^0C would turn brassy bland, while brown hair acquires at this temperature a reddish hue; black hair does not change colour (Spitz; 1980). Heat causes singeing of hair, with prolonged heat causing complete burning of hair. With very brief heating the hair tips have a terminal blob on the shaft end, like an unit match. This is due to melting of keratin in the distal end (nearest the heat) and its resolidification on cooling. This fate is seen in eyelashes, eyebrows, pubic, axillary and general body hair from singeing (Paul, George; 1996).

(K) EXAMINATION OF CLOTHINGS WORN BY THE DECEASED:

Burn injury, whether homicidal or suicidal, spreads rapidly as a result of inflammable fire accelerant materials present in the clothing. Most of these are volatile (e.g. hydrocarbons) and they escape by evaporation. For this purpose , examination of the clothings removed from the patient must be recorded . They will need to be handed over to the investigating officer and subsequently sent for chemical analysis. This forms an important link in the chain of evidence, similarly , hair

samples from the patient's scalp, if smelling positively for any chemical / accelerant, should be sent for chemical analysis (Wolfgang and Gunther; 1996).

(L) ANTEMORTEM OR POSTMORTEM BURNS:

A person may be murdered and heat may be applied to the dead body to conceal the crime. It is therefore necessary to know the differentiating features of antemortem from postmortem burns. The differentiation depends on the presence of a vital reaction as seen by the naked eyes or determined by histopathological examination.

An antemortem burn shows redness of the parts. If vesication is present, the blisters are surrounded by the thin bright red area of inflammation; they contain highly albuminous fluid, chlorides, and blood corpuscles; and after the blister is removed, the base is found to be injected. When a vesicle contains pus, it means that the person has lived for at least 36 hours after the injury. A postmortem blister on the other hand is limited in size, contains air, or if it contains fluid, it is practically nonalbuminous, without chlorides and blood corpuscles. Besides there is no line of hyperemia round the blister, and the base of the blister is not injected.

Catto (1959) suggested that amongst some of the conditions causing toxic epidermal necrolysis, blistering, and separation of superficial layers of skin, leaving a raw weeping surface closely similar in appearance to a scald whose blisters have ruptured, other than drugs and some diseases, a specific disease closely resembling and not enabling differentiation from a burn blister is Lyell's disease.

Extensive histopathological studies in burn deaths have shown unusual findings. Centrilobular necrosis of liver is reported in delayed deaths, and in liver of experimental animals dying of burns, who are not given topical therapy with tannic acid or silver nitrate. However, in cases treated topically with these substances, the damage to liver is more significant. It is now believed that this damage has a doubtful role to play in death. A finding of fat droplets in the blood vessels of lungs raises the suspicion of blunt injury. Fat embolism has also being reported on autopsy studies of burnt individuals (Teplitz; 1969). However, it can also be postmortem artifacts since heating of the body and postmortem burns may liberate fat droplets in the blood. However, these artefactual droplets do not crowd together and deform in the capillaries like true embolism. Release of lipase from pulmonary pneumocytes as direct response to toxicity of heat has also been reported (Sevitt; 1962). Systemic fat embolism has been reported in burns and some fat embolism is common in patients dying of burns, but if more than slight the cause of death may be something else. It is to be remembered that systemic fat emboli have also been reported to arise from rough handling of the body after death (Allardyce; 1971).

(M) POSTMORTEM ARTEFACTS:

There are many postmortem artifacts which may confuse the picture of antemortem injuries. It is not generally appreciated that when heat or certain chemicals are applied to the skin immediately after death, it may raise surrounded by a red areola indistinguishable from antemortem or agonal burns. The effect of heat on a dead body in front of a fire or from a hot water bottle would cause desiccation of the skin, discoloration resembling early charring and which lacks fluid but otherwise resembles a scald. If the epidermis, which is separated from the dermis in this case by a thin layer of fluid peals off, a wet and slightly erythematous looking dermis is exposed (Cameron; 1974).

(N) PREDICTABILITY OF SUICIDE:

Based on demographic studies by psychologists and psychiatrists, much work has been done on suicide predictability and intervention studies. An often quoted and referred social readjustment rating scale by Holmes and Rahe (1967) is based on amount of stress. 43 Life crises are rated mathematically on a stress scale. This scale gives a maximum stress rating of 100 Life Change Units (LCU) to death of spouse. Marriage - though a pleasurable experience for most - does cause stress, and has been rated at 50 LCU on this scale. Divorce is rated at 73. The event which is supposed to cause the lowest stress (among the 43 events listed), is Minor violations of law, which causes a stress of just 11 Units.

The Life Change Units of a person are added yearly. 150-199 LCUs in a single year are supposed to cause "mild" stress level, 200-299 LCUs, a moderate level and 300 LCUs or more, a major crisis level. Health problems in these cases increase by 37%, 51% and 79% above the average, respectively.

Such a scoring may have relevance for western societies which rate marital separation at 65 LCU, divorce at 73 LCU and pregnancy at 40 LCU. However in an Indian context - especially for a woman - a divorce or separation may sometimes cause equal or even greater stress than death of a spouse. Besides it is doubtful in this scheme whether they would not score as above 100 LCU setting on fire one's spouse which many Indian males have exposed in the last 2 decades without stress.

In intervention studies on suicidal patients in the western scenario, a table of demographic and relevant factors evolved as lethal and nonlethal markers as predictors of suicide makers for calculating the potential to commit suicide. The study has defined 5 demographic factors and 7 relevant factors. These are totaled on a worksheet to quantify the score. This work has predicted that a total score of 10 to 20 has low suicidal risk, through increasing risk per rise in score by 10 points to a score above 40 cited as extremely serious suicidal risk requiring urgent suicide protection / intervention. These research have been attempted to categorize suicidal persons into either manipulations, hopeless, helpless, guilty, sufferers of loss, isolates, exhibitionists, intimates (already closely associated with some near one's suicide), murder by suicide or suicide by murder. The latter two are complex medico legal problems, as an often threatening suicidal patient, who as a parasuicide ensures that his/her life is really not threatened, many times this was attempted suddenly is found to have paradoxically successfully killed themselves in a manner ensuring that death was certain, in circumstances to the advantage of the person usually being threatened each time by the parasuicide; while in suicide by murder, the person seeking suicide ensures he/she dies off another's hands which ends in that other person gets charged with murder (Victoroff, Victor; 1983). Other than this there are also those cases where murder is followed by suicide of the murder; the offenders show a high preponderance of woman and the victims children (Gunn et al; 1993).

Investigations of whether there are any predictive biological markers for suspecting any suicidal tendency have raised certain subjective markers. A marked reduction of Mono amino oxidase levels in the platelets have been found in high risk patients, while a low 5 hydroxyindole acetic acid levels suggest an increased tendency to suicide by violent means. A genetic disposition has been suspected from suicidal attempts even in the adopted well supported sibling emulating his deprived sibling unknowingly in attempting suicide. Psychosocial fixtures such as despairing mood as well as a familiar from imitative behavior have also been noted (Victoroff, Victor; 1983).

To opine on the scenario, from the scene of crime and the burn pattern on the body as to whether this was a case of suicide or otherwise is difficult as the scene of crime and the final result of the burns on the body is the end result of so many varied factors affecting burning e.g. use of accelerants, position of the body whether erect, crouched or flexed or lying on one side, the fallen side from severe burns, duration of exposure to heat and its temperature , behavior of the fire whether fuel regulated or oxygen regulated, occurrence of 'flash out', back draft burning. These factors which are not evident or easy to be ascertained after the fire is put out. However, based on some of the features detailed above some surprises can be made, though these may not fall in the domain of final certitudes.

As far as court of law, interpretation as to whether the burns sustained were suicidal in nature or otherwise, judgment till date have gone more by corroboration of statements of witness involved including deceased dying declaration of the circumstantial evidence available rather than scientific aspect of the investigation into the burns seen and sustainance of injury (Ganesh Lal; 1992 and Vishnu Bapu Rao & Lokhande; 1995).

(O) UNNATURAL FEMALE DEATHS VIS-A-VIS BURNS:

Corey, et al (1992) reported the attempted concealment of cause and manner of death by nursing home personnel owing to fear of criminal or civil proceedings, thereby creating a difficult task to find out the exact pattern of the cases. However, the victims of such incidence are probably the closest onlookers, but unfortunately cannot tell the tale (Raymond; 1987).

The modern society has been active and alive to the needs and problems confronted by women. The period of 18-30 years of age forms the most important and crucial part of woman's life. She has to face many types of burden i.e. mental, physical, social, economical or psychological. This is the age for marriage, change of social environment, taking up of job responsibilities, bearing and rearing of children. Many studies as well as experience and common observations have revealed that family is the first place where most of the women experience physical violence and ill-treatment. They became the target of extreme degree of violence by their husbands, in-laws and other relatives. Violence against women is practiced in various forms in everyday life in all societies. WHO (1987) has stated that measures should be formulated to prevent violence and to assist female victims.

Unnatural death is one of the indicators of the level of social and mental health (Shamsue; 1994). Responsibility for prevention of violence in our society should not rest only on the law enforcement personnel. Public health and other human service agencies including voluntary organizations should assist in preventing primary violence for this may help to prevent other major causes of morbidity and mortality (Jason, Strauss & Taylor; 1962). Violence against women in a marriage or cohabitant is often not brought to the surface unless direct questioning is performed as shown in earlier investigations (Peterson & Jacobsen; 1980 and Leiren; 1982).

The higher incidence of unnatural female deaths in the age group of 18-30 years i.e. young females, especially due to very high incidence of accidental burn injuries within seven years of marriage, certainly points to some underlying factors. These deaths in general and homicidal and suicidal burn deaths in particular, have genuinely termed as "Bride Burning" or "Dowry Deaths" and on enquiry, it is generally found that the case has been reported to the police mostly by villager, girl's own family members or a distant relative and seldom by in-laws and husband (Verma and Das; 1990). The high incidence of burn deaths, especially in young females, may be due to cooking on

open unguarded flames (Gupta and Srivastava; 1988). It is to be noted that the cooking responsibility is usually assigned to newly married house wives in most of the families in Northern India. Loose Voluminous, highly inflammable, synthetic garments, sarees of the victims (sarees are long pieces of cloth traditionally worn round the waist by Indian females), catch fire suddenly while cooking. Kerosene oil, match sticks and other cooking material, being easily available in houses, is usually preferred by Indian women to commit suicide, and as for as killing, it helps to hide not only the torture and other means of murder but also renders identification of victim difficult at postmortem examination.

Dowry deaths & bride burning are of frequent occurrences in India (Gupta and Srivastava; 1988). Most of the cases are reported among business communities and pertain to young females ranging in age between 19-25 years, within 2-6 years of marriage, the root cause being dowry. The investigation of such a case is very difficult mainly because of complex situations such as false counter allegations from complainants and accused parties (Gaur and Sangwan; 1991). Such cases need thorough investigation for launching the prosecution. The age range was observed from the angle of age of marriage legally allowed in India for female i.e.18 years (Gaur; 1991). As per section 304 B, a women dying within 7 years of marriage (less than 30 years age) is suspected "Dowry Death" (Gaur; 1993).

According to Bangal et al (1995) , it is found that maximum victims are in the age group of 15-30 years with clear-cut female preponderance. Mortality in the present study is found to increase with the extent of burns and highest number of death (54%) occurred with burns exceeding 60% of body surface. Workers like Bang (1990) and Naik et al (1991) also quote similar observations.

According to Satpathy (1995), many young newly married females die from burn injuries, the most common reasons given in postmortem reports therefore being that she caught alight (a) while cooking (b) after an oil explosion in a stove: or (c) when a chimney fell on her at night. These are the usual explanations given in postmortem requisition documents furnished by the police, but on enquiry from the relatives and neighbors, many were found not to be true. The study revealed that in most cases burn deaths the investigating agency (the police) recorded the cause of deaths in the postmortem requisition forms as accidental, subsequent investigations generally found this to be false. Hindu females comprised on alarmingly large group and most deaths recorded in the 16-30 years age group.

According to Bhullar et al (1996), majority of married female victims (74.29%) died or were killed within 7 years of marriage. A great majority of victims (91.43%) were either illiterate, under matric or matriculate only. Regarding manner of death, accidental cases are most common. In majority of the victims, the causative agent leading to death were burns (70%) followed by poisoning (15.71%) and vehicular accidents (7.14%). In laws house is the commonest locale (60%) and most of the victims (68.75%) die or are killed between 4 PM to 6 PM.

According to Nagesh Kumar (1997), it is true that most of the cases referred for medico legal autopsy by the police usually have a brief history of stove burst (63.3%), while cooking in kitchen invariably. The statistical analytical results on age incidence of burn reveals the facts that the burns in females is more common in age group 19-39 years, highest preponderance being observed in age group 19-25 years (26.7%) i.e. during first 7 years period of marriage (18 yrs) being age of marriage for female by statute in India. These observations are clear pointer to the fact that burns death in females are mostly deliberate giving credence to the concept of 'Dowry Deaths' rather than mere

accidental, the plea usually taken by the defence. These facts convey the message that in every case of female burns whatever be the explanations given by non-blood relatives of the victim, a thorough investigation must be conducted by the investigating officer (I.O.) or magistrate, providing proper history to the Forensic/ Medico legal expert, allowing him to pick up slightest clue available during autopsy and decide whether the case is in favour of homicide or not.

ASPHYXIAL DEATHS:

Drowning:

In the case of drowning the lines of demarcation between accidental, suicidal or homicidal deaths are almost invisible. The victim could be pushed into the well or river or could fall accidentally or might even have deliberately jumped into to take her own life.

One thing the investigating agency must discover in case of drowning is whether drowning is antemortem or postmortem. There is a possibility wherein it may not be possible to ascertain whether death occurred before drowning or after drowning, for while throwing the victim the death might, occur half way due to the shock though the body systems still function and in such situation it will elicit all signs of antemortem. But such a case may be by and large of academic interest only.

The real difficulty, therefore, is to find out whether the drowning is accidental, homicidal or suicidal. Here again, the facts and circumstances of the case are relevant to the issue and it may be quite a frustrating experience for the investigating agency to try to reach the truth. Such cases are really controversial and any set of situations are likely to lead to more than one probable results.

Heurek, Van.H.(1899) pointed out that sea water diatoms are more fragile than their fresh water cousins because they contain less silica so more easily digested by acidic treatment while processing to clear the other organic matter.

Revenstorf (1904), made advances in diagnosis of drowning by showing microscopic particulate matter present in fluid medium which is expressed from peripheral portion of lung which penetrate into peripheral portion of lung during life. This particulate matter is called " Plankton" consisting of algae, diatoms and variety of microscopic debris.

Spitz and Schneider (1964), stated that the presence of diatoms is not a definite proof of antemortem drowning. He exhibited the presence of diatoms in liver of cadaver who died of causes other than drowning. So, he concluded that presence of diatoms is not diagnostic of antemortem drowning.

Timperman, J. (1969), stated that the findings of diatoms in the tissues of body particularly liver, kidney, bone marrow were absolutely diagnostic of drowning.

Timperman (1972) has dealt with the mechanisms of drowning. When a person drowns, the lungs aspirate more and more water, until finally the lungs are filled with water. This creates pressure and the peripheral alveoli of lungs rupture admitting water and its contents to the blood system. This water is circulated round the body until death. Diatoms present in this water are also carried round and therefore reach many parts of the body. The presence of diatoms in enclosed tissues for example bone marrow is an indication that drowning has occurred.

Hanging:

According to Shah and Desai (1995), hanging is a major cause of all asphyxial deaths. This mode is a favorite for suicidal death. The prime reasons for hanging to be used as suicidal method is due to the following reasons:
(a) Easy availability of material
(b) Minimum pain
(c) Least time required
(d) Almost 100% success in first attempt

The usual cause of death in hanging is asphyxia because of pressure and blockage of trachea and sometimes compression of vagus nerve and carotid sheath. In all hanging cases, the ligature mark is always on the front and then going backwards and upwards upto nape of neck to make it either complete or partial hanging. Truly speaking, it becomes difficult to establish whether it is a suicidal or homicidal case. In available ligature, it is mentioned that if the course of ligature is transverse or upwards or backwards, it goes in favour of suicide or otherwise, homicide. Circumstantial evidences can only be of some help.

Strangulation:

In the study of strangulation, Srivastava, Das and Tripathi (1988) found that the victims were first killed and then burned to hide the crime in 38.46% of cases. Thus perpetrators get enough opportunity to tamper with or destroy the circumstantial evidences alone or in collusion with the police officers, the only important basis to differentiate suicidal, homicidal or accidental burns.

POISONING DEATHS:

According to Bhullar (1996), different types of poisons especially aluminum phosphide (ALP) marketed as tablets of Celphos, Alphos, Quickphos etc, has emerged as dangerous weapon to end human lives due to its easy availability; being cheap, efficacious and easy to use; and non availability of an effective antidote. Now it is the single most frequent suicidal method in North India. Besides dowry , mental stress due to various reasons, maladjustment in the married life, usually by the in-laws, family structure, family quarrels, infidelity, level of education, joint family structure, unemployment, dependence of women on in-laws and the other contributing factors affecting the marital happiness in one or other ways.

Human, toxicity, which is usually acute, occurs due to the toxic effects of phosphine which is released in the stomach after ingestion of ALP. According to Chefurka et al (1976), phosphine gas acts as a strong inhibitor of mitochondrial respiration in active state, which is irreversible by uncouplers suggesting its direct effect on electron transport, an important electro-chemical link between respiration and phosphorylation.

On Histological examination, Singh et al (1985) observed nonfibrinous pulmonary oedema in lungs. In the liver they found mild fatty infiltrations, areas of centrizonal necrosis with hemorrhage, small granuloma containing lymphocytes and few macrophages, occasional polymorphonuclear cell; in kidneys, medullary congestion and hydropic degeneration of tubular epithelium are present ; the brain and myocardium are normal. Chugh et al (1989) reported oedema, mild fatty changes and centrizonal necrosis in the liver. In the lungs, authors have found oedema, thickening of alveoli and intra-alveolar septa by haemolysed R.B.Cs. along with areas of grey/red hepatization and aggregation of round cells around bronchioles. Further according to them the heart shows focal

areas of congestion, necrosis and oedema and kidneys have congestion, necrosis and areas of tubular degeneration and regeneration. In suprarenal glands, areas of mild to complete lipid depletion, massive hemorrhages and large areas of congestions and necrosis are noted.

In order to avoid loss of life as a result of self poisoning with aluminum phosphide, Government of India (Ministry of Agriculture) had constituted a "working group" for laying down safety in use of aluminum phosphide. Expert of this group in their meeting held on 6.3.1991 at Faridabad under chairmanship of Prof. P.L. Sharma of this institute had recommended that some emetics be incorporated in the pesticides and that each tablet should be dispensed in unbreakable, hard, perforated plastic pack. Had these recommendations been made effective, a large number of valuable lives could have been saved.

OTHER MISCELLANEOUS CAUSES:

Other causes of dowry deaths depend upon the process used for the purpose, which may be in the form of Firearm weapons, Blunt objects etc.

Wolton et al (1977) stated that when evidence of fire arm wounds have been destroyed by postmortem burns of the body, radiological demonstration of the site and direction of the bullet in the charred remains is possible. However, it must be remembered that a bullet keeps tumbling nose-to-tail in its main trajectory after penetration. It may enter nose first, but tumbles and exit out of a large mass tail first. This phenomenon further hampers true reconstruction of events. The fact that the bullet is enclosed by and carries evidence of cooking of human flesh where it is embedded, is subjective proof of its presence before burns are inflicted. Wound ballistics received a tremendous boost from co-ordination of advanced techniques like computer aided X-ray diffraction linked with scanning electron microscopy (SEM) of the entry wound. The combined method-energy dispersion of x-ray (EDAX) yields valuable information on the exact composition and quantitification of the propellant detonator.