CHAPTER - 1

INTRODUCTION

Hanging is one of the 10 leading causes of deaths in the world . In India hanging is one of the common methods of committing suicide along with poisoning ,burning and drowning .The incidence of suicide by hanging. The fact that 71% of suicide in India are by persons below the age of 44 years imposes a huge social emotional and economic burden on our society. Suicidal hanging in a particular geographical area is very much necessary to prevent such suicides.

Hanging is cause of Asphyxia, Deaths due to asphyxia are caused by failure of cells to receive or utilize oxygen. The deprivation of oxygen may be partial (hypoxia/ suboxia) or total (anoxia/anoxemia). Literal meaning of word 'asphyxia' is 'no pulse' (pulse less). It is also understood as a 'state of low oxygen' (hypoxia/suboxia, anoxia, etc). Thus the terminologies anoxia, anoxemia, suboxia, hypoxia, etc. are though considered as better ones, the terminology "asphyxia" remains accepted in true medicolegal sense globally. However, the pathophysiology would include biochemical and neurological mechanisms.

Asphyxia is defined as lack of oxygen in blood and tissues due to impaired or absence of exchange of oxygen and carbon dioxide on a ventilatory basis, leading to death.

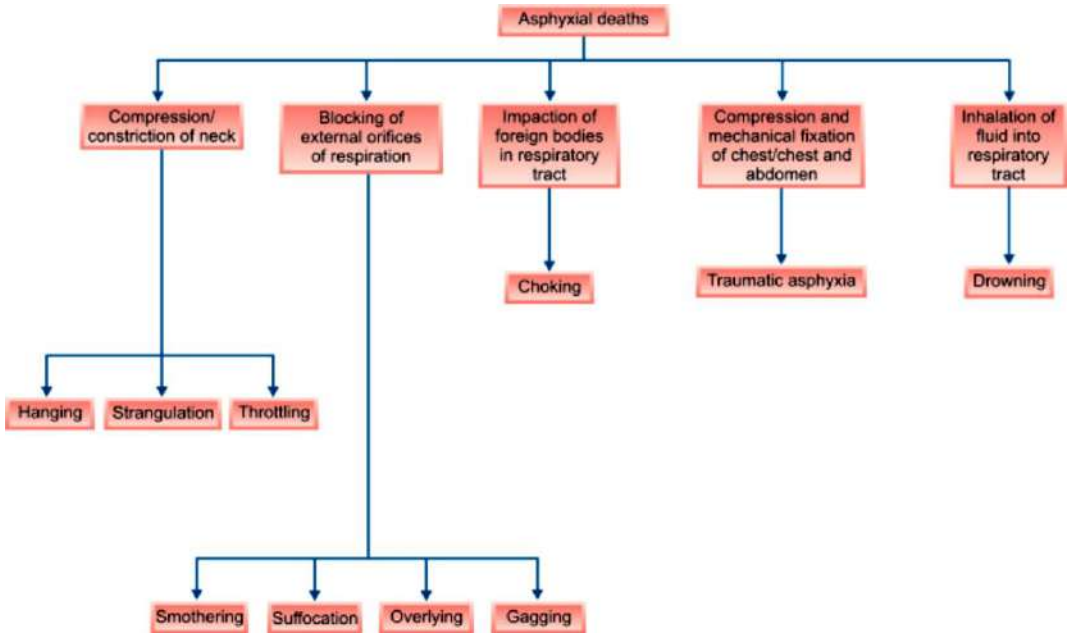

Fig. 1.1 Classification of Asphyxial Deaths

Hanging is defined as complete or partial suspension of the body by a ligature tied around the neck and force of constriction on the neck being applied by the weight of the body hanged.

In hanging, death is usually due to asphyxia or cerebral anoxia or vagal inhibition leading to cardiac arrest or injury to the spinal cord as observed in judicial hanging wherein death is due to fracture-dislocation of the C2C3C4 vertebrae. In hanging and ligature strangulation, a ligature mark may be produced by local damage to the skin of the neck due to pressure may be associated with an additional lateral rubbing action into associated abrasion.

The ligature mark may be only the evidence available in cases of hanging and its characteristics are well noted in literature. Depending upon the duration of suspension the furrow is initially pale or yellow parchment like area with the rim that congested or with slight it form hemostasis. But the features of the ligature material are not reported for systematic analysis.

Classification of Hanging:

- Complete hanging—both feet are not touching the ground
- Partial hanging—both feet or any other parts of the body are touching the ground. Thus, it may be also induced in sitting, stooping, kneeling, lying prone or supine positions.
- Typical hanging—knot of ligature is on the backside of the Neck.
- Atypical hanging—knot of the ligature is anywhere other than on the backside of the neck. Usually location for the knot is near the mastoid process or angle of mandible. Occasionally, it may be under the chin.

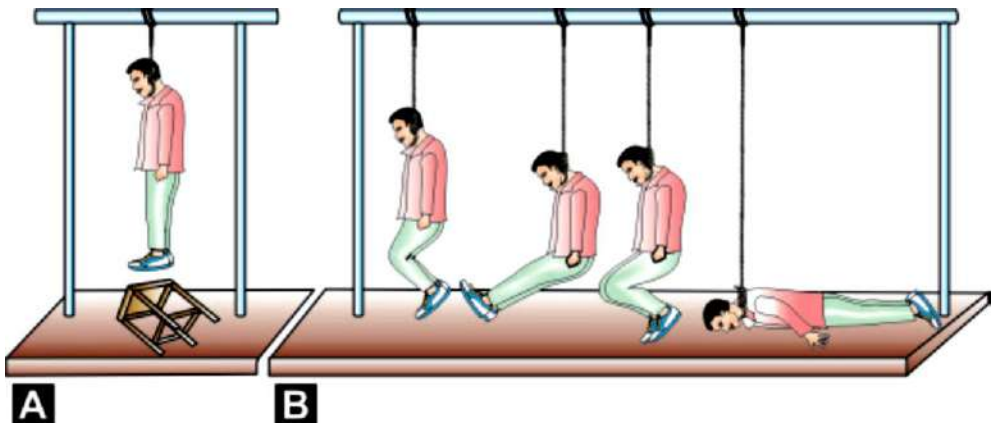

Fig. 1.2 Types of Hanging
A. Complete B. Partial.

Fig. 1.3 Complete Hanging & Partial Hanging

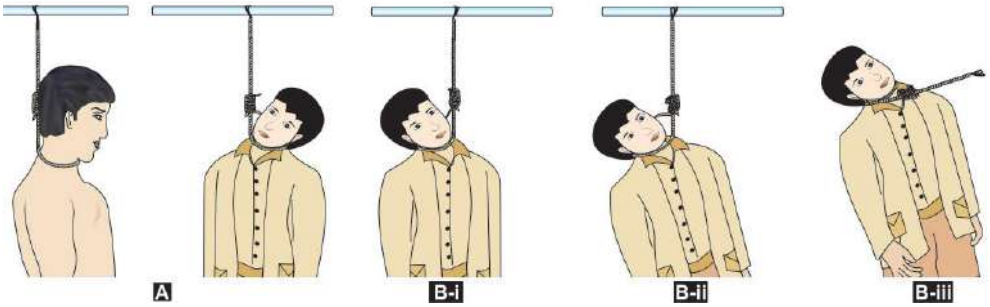

Fig. 1.4 Types of hanging: (A) Typical and atypical hanging. (B) Possible ligature mark positions in the neck in hanging: (i) More common/usual position with fixed noose and high suspension. Mark rises high and may show a gap; (ii) When a slip knot is used it results into a smallest loop, that tightens maximum resulting into a deep ligature mark in the neck, could be low and horizontal; (iii). When the suspension point is low and victim leans away and mark will be horizontal, misleading for strangulation

Mechanism of Hanging:

It has been scientifically accepted that pressure on the neck can result in occlusion of neck structures for respiratory functioning, developing asphyxia. Experimentally, it has been proven that pressure/force of 2 kg (4.4 lbs) and 4-5 kg (8.8-11 lbs) on the neck can occlude jugular vein and carotid arteries respectively, 15 kg (33 lbs) can occlude trachea and 30 kg (66 lbs) can occlude vertebral arteries.4,8 All these can bring about gross decrease in cerebral blood flow leading to cerebral anoxia, asphyxia and death.

The knot **–** Among most of the right handed suicide victims, knot is usually seen on the right side of the neck as it is easier for the victim to tie himself/herself. Knot may be a slip knot or granny knot. Common site for the knot is either right side or left side of the neck. It could be also on the occiput. Occasionally it is seen below chin also. Ligature marks tend to be deeper opposite to the position of knot. When hanging is from a low point of suspension or partial hanging, the mark may be horizontal and could resemble strangulation. However in most cases of hanging it is above the level of thyroid cartilage.

Fig. 1.6 Slip knot/granny knot (left) and Hangman's noose used in judicial hanging (right)

AUTOPSY FINDINGS

Autopsy findings are discussed under two heads; external and internal findings.

EXTERNAL

All external findings are better sedlt under three heads, namely:

I. Findings in the face
II. Findings in the neck
III. Findings in Other parts of the Body

Ligature mark of hanging – A detailed knowledge about the ligature mark of hanging essential for an autopsy surgeon, is highlighted precisely in Figures 15.5G to K, and described below:

Site – seen round the neck; usually situated above the thyroid cartilage (Adam's apple) in about 75 per cent of cases of hanging, at the level of thyroid cartilage in another 15 per cent and below the thyroid cartilage in remaining 10 per cent cases.4,7,8

- Size/shape – depends on the type of material used.
- Cause – weight of the body tightening the ligature material around the neck.
- Appearance – A typical ligature mark is usually seen in antemortem hanging. It is also reported to appear if hanged immediately after death or within a period of 2 hours of death (vide infra).11 However, ligature mark produced so will not be as prominent as in antemortem hanging.

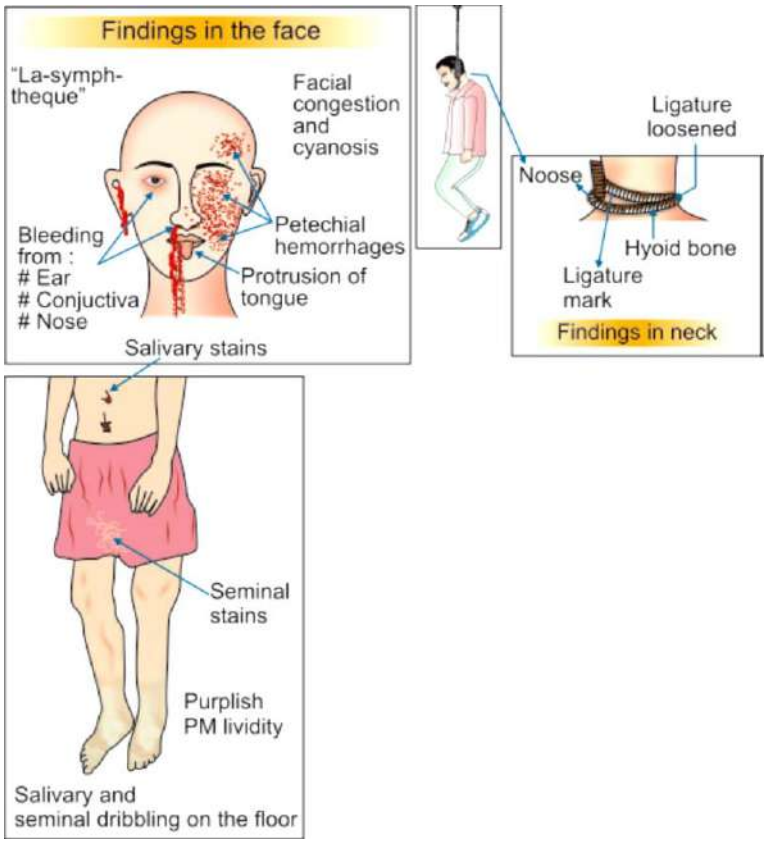

Fig. 1.5 External autopsy findings in hanging

INTERNAL

Internal autopsy findings include findings in the neck, lungs, heart, brain, other abdominal viscera and blood.

- Findings in the lungs – Lungs will be congested, distended and emphysematous with plenty of hemorrhagic spots (Tardieu's spots) subpleurally. Cut section usually exudes frothy fluid blood, if constriction occurs at the end of exspiration. It would be pale with little or no congetion, if constriction occurs at the end of inspiration.
- Findings in the heart – Heart is congested and shows Tardieu's haemorrhagic spots over the pericardium. Right side of the heart, pulmonary artery and vena cava are usually found full with dark fluid blood, while left side empty.
- Findings in the brain – Brain and its membrane will be congested and with or without scattered petechiae on its surface and substance.
- Findings in abdominal viscera – All the abdominal viscera are congested.
- Blood changes – Blood will be fluid and purplish in colour.

- Neck findings – In every case of death by hanging, a careful dissection of the neck is done, layer by layer, so as to not to miss any of the internal findings, confirming hanging as the cause of death. This is possible only if the dissection area is maintained clean free from bleeding, which can be only achieved by a special technique called bloodless dissection of neck.

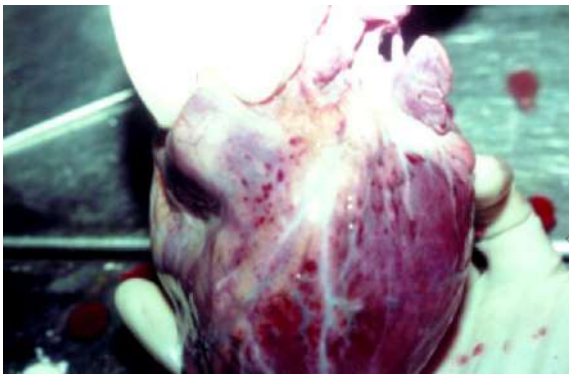

Fig 1.6 Tardieu Spots on Heart

Forensic Anatomy of Hyoid Bone and Larynx

Hyoid Bone: This is a bone described is have a 'U' shape, with a central horizontal body; to which 'greater horns' are attached on either side by a natural joint. The greater horn lie behind the sternomastoid muscle at its front part, 3 cm below angle of mandible and 1.5 cm away from the midline. Usually, the connection between greater horn and hyoid bone body is cartilaginous in early life, while after middle age it turns bony.

Larynx: Larynx is a neck structure in the mid-line anteriorly. However, its exact location varies with sex and age. In an adult male, it lies opposite 3rd-6th cervical vertebrae, while in a female, it is at a higher position slightly. It comprised of nine cartilages; namely, thyroid, cricoid, epiglottis and smaller pairs of cuneiform, corniculate and arytenoids. Thyroid and cricoid cartilages are more important.

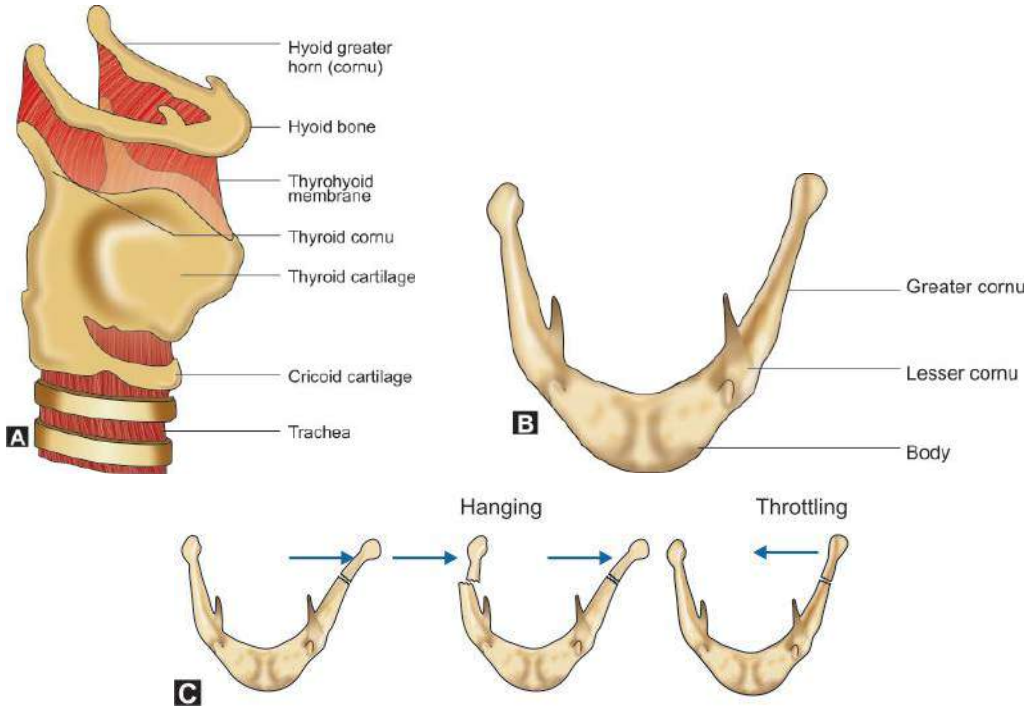

Fig. 1.7 (A) Anatomy of the larynx, (B) Hyoid bone (Normal morphology), (C) Fracture of hyoid bone in hanging and throttling (probable mechanisms)

Mechanism of Fracture and Fracture Dislocation of Hyoid Bone

Hyoid bone—usually reported to remain intact (90-95%). However, if fractured it is usually seen in age group of 40 years and above, at the greater cornu at the junction of inner two-thirds with outer one-third.

These fractures usually fall under any one of the following three types:

- Antero-posterior compression fracture – Here the distal fragment gets desplaced outwards and periosteum may be torn on the inner aspect.
- Side-wise compression fracture – Here the distal fragment will be bent inwards and the periosteum may be torn on the outer aspect. It is possible that one or both the horns may be fractured due to compression on one or both sides, with one horn fractured on to inner side and the other on to the outer side.
- Traction/Avulsion/Tug fracture – Here due to the powerful muscles attached to the upper and anterior surface of hyoid bone, it is drawn up and held rigidly. Violent lateral or downward movements of thyroid cartilage or pressure between the cartilage and hyoid bone can bring about the traction through thyrohyoid ligaments resulting into this

fracture of the hyoid bone. These fractures are usually with extravasation or blood in soft tissues around; need not be seen in all cases of antemortem hanging. It is said that circulation gets compromised during hanging and hence no bleeding is seen even if the hanging is antemortem.

Suicidal Hanging

In India, hanging is a common mode of committing suicide among men., highlights the differences between antemortem and postmortem hanging (postmortem suspension). Age is no bar for suicide by hanging. Author held an autopsy on a boy of 12 years who committed suicide for not able to get admission in a private school due to high fee. Partial hanging is almost diagnostic of suicidal hanging. Physically disabled, blind person, lame, amputated arms, or forearms – all have successfully committed suicide by hanging

CHAPTER - 2

LITERATURE REVIEW

2.1 Th MEERA ,M.BAPIN KUMAR SINGH

RESEARCH TOPIC WAS PATTERN OF NECK FINDINGS IN SUICIDAL HANGING.A STUDY IN MANIPUR.

10.71%had slip knots .comin present study,the maximum number of cases was seen in the age group of 21-40 years. These findings may be compared with the findings of Br sharma et al and nikolic S et al.some of the causative factors in these age groups in the present study include drug abuse ,mental illness ,unemployment ,poverty and marital disharmony mostly in females. in a study on 84 cases ofr suicidal hanging brought for autopsy to thw mortuary of the regional institute of medical sciences ,imphal during 2004to 2008 ,it was observed that 77.38% of the cases were males and 22.62% were females. The highest number of victims was in age range of 21-40 years .73.81%of the committed suicide indoors and 57.41%of them used ropes as ligature material.85.75%of the victims had fixed knots with a single turn and plete atypical hanging constituted 88.10%of the cases .23.81%of the cases had tear of the carotid artery and 3.57%had hyoid fractures. None of the cases had cricoid or trachea fractures .the neck findings vary depending upon the composition, multiplicity and the tightness of the ligature material used.

2.2. Dr.BR.SHARMA,Dr.D HARISH, Dr.VIRENDRA PAL SINGH,Dr.RAMINDERJIT SINGH,

RESEARCH TOPIC WAS LIGATURE MARK ON THE NECK:HOW INFORMATIVE ?

Many times ,a ligature mark may be the only evidence available in cases of asphyxia deaths due either to hanging strangulation. A through ,a must to arrive at the most probable cause of death and differentiate between hanging and the ligature strangulation .a retrospective study was conducted arb the Department of forensic medicine and toxicology ,government medical college and hospital ,chandigarh between 1997 to 2004 to assess the information provided by a ligature mark in such cases deaths due to hanging constituted 3.4% of the total unnatural deaths subjected to the medicolegal autopsy.

2.3.N. VIJAYA KUMARI.

RESEARCH TOPIC WAS SUICIDAL HANGING:A PROSPECTIVE STUDY.

The objectives of this study was to focus on various factors associated with suicide bt hanging at Chennai ,India ,with a view to identify the areas of intervention a prospective study was carried out on 65 cases of death due to suicide but hanging which was received by the institute of forensic medicine ,madras college ,Chennai, India ,during the period of august 2008-july 2009

In the present study ,84.7%of the cases were below the age of 40 years ,time of hanging in 50.8% of the cases was 3am -12 noon ,place of hanging in 95.5%of the cases was their residence,92.3%were living with their family and 69.2% were married .most frequent precipitating factors were marital unhappiness 33.8% problems associated with organic disease 18.5%and dowry harassment 16.8%.to reduce the incidence of suicides by hanging ,there is urgent need to focus on these factors.

2.4.VIPUL NAMDEORAO AMBADE,NILESH TUMRAM,SATIN MESHRAM, JAYDEO BORKAR

RESEARCH TOPIC WAS LIGATURE MATERIAL IN HANGING DEATHS:THE NEGLECTED AREA IN FORENSIC

This study was focused on the hanging mark and its characteristics .The most relevant feature of hanging and its characteristics are well known in the literature. Most of the time,the ligature material is not available during autopsy examination in hanging. Hence, the features of the ligature material are not submitted to systematic analysis. However,the type and position of knot plays an important role in the mechanism of death and autopsy findings hanging. Out of the total hanging deaths, complete hanging was seen in 67.7% of the cases,but a typical hanging was noted in only 10.2% of the cases. The commonest type of ligature material used for ligation around the neck was nylon rope followed by odhini and jute rope. Most victims committed suicide by hanging in their homes, and the commonest ligature points were trees, flowed by beams and ceiling hooks/fans.

2.5. SLOBODAN NIKOLIC MD PhD, VLADIMIR ZIVKOVIC MD PhD,DRAGAN BABIC MD PhD,FEHIM JUKOVIC MD,TATJANA ATNASIJIEVIC MD PhD AND VESNA POPOVIC MD PhD.

RESEARCH TOPIC WAS HYOID-LARYNGEAL FRACTURE IN HANGING: WHERE WAS THE KNOT IN THE NOOSE

The aim of this study were to determine the frequency in of hyoid-laryngeal fractures in hanging in relation to the position of the ligature knot, to reconstruct the location of the ligature knot in cases of hanging when the furrow is not detectable on the skin, and to identify the possible mechanism of the neck structures injuries.The autopsy study which included 557 cases of suicidal hangings:413 men and 144 women, with an average age of 52.4+17.8 years. In 57.3% of them, hyoid laryngeal fractures were found 15.1% had only hyoid bone fracture,26% had only thyroid persons aged over 30 years.Absence or presence of any form of hyoid laryngeal fracture indicated that knot position was anterior or posterior, respectively.

2.6. JOSM.SUAREZ-PENARANDA, M.D., PhD., TERESA ALVAREZ,M.D.,XON MIGUNS M.D,MARA C.RODRIGUEZ-CALVO,1M.D.,PhD BONITO L PEZ DE ABAJO,M.D.,MARA CORTES M.D

RESEARCH TOPIC WAS CHARACTERIZATION OF LESIONS IN HANGING DEATHS

The study was focus on common method of committing suicide and a routine task in medico-legal autopsies. The hanging mark is the most relevant external sign and its characteristics are well known, but, for unknown reasons, their are major differences in reports on internal findings. We retrospectively studied 228 consecutive cases of hanging that. A complete standard autopsy was for every case. We investigated the association between the characteristics of the hanging mark and the frequency of bone, cartilage, soft tissue, and vascular injuries with the mode of suspension. Most cases (75.3%) presented some kind of bone are cartilage fracture, but these were unrelated to any of the variables studied. Vascular lesions are clearly more infrequent: intimal injuries were found in the carotid artery (9.1%), the jugular vein (2.2%), and ruptures of the carotid adventitial layer (21.7%). These could be partially associated with the use of a hard fixed noose and body weight.

CHAPTER – 3

AIM & OBJECTIVES

AIM: Forensic Analysis of Ligature in Suicidal Hanging.

Objectives:

1. Suicidal Hanging Deaths Data Collection from Govt. General Hospital, Kakinada.
2. Analyzing, Segregating and Interpreting the collected data according to Ligature specificity.

CHAPTER – 4

METHODOLOGY

This prospective study was conducted during January 2016 to December 2016 and January 2019 to December 2019 at forensic department and toxicology government general hospital Kakinada. During this period we received 90 cases of deaths due to suicide bt hanging for autopsy.

Included cases in which the history and scene of crime examination report given by investigating officer and the history given by close relatives and friends who attended the inquest were suggestive of suicide by hanging.

Information regarding srx, age, place and time of hanging, ligature material(rope, wire, clothes, sheet)type of ligatures were regrouped into two broad categories like narrow and wide. Examples of narrow ligature include rope, electrical cords and shoe strings, whereas the term wide ligatures encompass pieces of clothing and bed sheets type of knot, contusion of neck tissues and ligature points used, any history of alcoholism and drug addiction (details of toxicology report) were collected. Took a detailed history regarding the possible precipitating factors for committing suicide.

Strangulation cases are very rare. I didn't get strangulation cases from 2016 and 2019.

A total of 90 suicidal hangings deaths were found in 2016 and 2019 but 25 cases are pending, a total of 65 cases were analyzed.

CHAPTER - 5

RESULT

It was observed that the maximum number of cases was seen in the age group kjof 21-30 years (27.69) followed by 31-40 years (21.30%a). Males accounted for 64.58% of the cases as compared to 35.36% in females.(table 1)

96.92% of the cases occurred indoors like bedroom, bathroom, toilet, kitchen, etc., and remaining occurred outdoors 3.07% as shown in (table 2.)

43 cases (66.15%) used cloth as a ligature material which were either saree, chunni, bedsheets, towels, etc., and 33.85% used ropes like nylon or jute. (table3)

It is observed from Table 4 that a single turn of the ligature with a fixed knot was seen in 57 cases (87. 69%) and slip knot in 9.23% of the cases.

96.92% of cases showed pale, white, glistening tissue underneath the ligature mark and only 3.08% of the cases showed mild contusion of neck tissue. (Table 5)

Post mortem blood investigation does not reveal alcohol intoxication or drug addiction in any of the cases.

CHAPTER – 6

CONCLUSION

The high incidence of suicidal hanging among young adults, especially females imposes a huge socioeconomic burden on our society. Neck findings in suicidal hanging cases vary depending upon the composition, multiplicity and tightness of the ligature material used the suspension time, type of hanging etc., Hence, the possible findings in a suspected case of hanging must be always anticipated so as to avoid any erroneous opinion.

TABLE 6.1: AGE AND SEX DISTRIBUTION

AGE (in years)	**Male**		**Female**	
	No.	P.C(%)	No.	P.C(%)
0-10	0	0	0	0
11-20	7	10.76	3	4.61
21-30	16	24.61	18	27.69
31-40	8	12.40	1	10.53
41-50	7	10.76	1	1.53
51 above	4	6.15	0	0
Total	42	64.58	23	35.36

TABLE 6.2: PLACE OF OCCURRENCE

Place	**No.**	**P.C(%)**
Indoors	63	96.92
Outdoors	2	3.08
Total	65	100

TABLE 6.3: TYPE OF LIGATURE MATERIAL USED

Ligature Material	**No.**	**%**
Cloth	43	66.15
Rope	22	33.85
Total	65	100

TABLE 6.4: NUMBER OF TURNS OF LIGATURE AND TYPE OF KNOT

No of turns	Fixed knot		Slip knot	
	No	%	No	%
One	57	87.69	6	9.23
Two	2	3.07	0	0
More than two	0	0	0	0
Total	59	90.76	6	9.23

TABLE 6.5: INJURY TO THE NECK TISSUE

Type	No	%
With contusion	63	96.92
Without contusion	2	3.08
Total	65	100

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