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A Five-Year Retrospective Study of Deaths Due To Constriction of Neck

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Abstract
Introduction*: Hanging and strangulation are amongst the commonest modes of violent asphyxial deaths. Usuallydeaths from hanging are suicidal and those from strangulation are homicidal in nature.****Methods****: During thisretrospective study offive-year period, 3264 cases were autopsied. Among them,the cases of hanging and strangulation were 3.86%. **Observations**: Numberof cases of hanging was 96 (76.19%), and ligature strangulation was 24 (19.04%). Males constituted81.25% of cases of hanging and 91.66% of ligature strangulation. In the second decade of life, 87.5% cases of deaths due to hanging occurred while 71.42% casesof strangulation were reported in third decade of life. Maximum cases of deaths due to hanging were reported in morning (29.17%) and of strangulation during afternoon (37.50%). All cases of ligature strangulation were reported fromrural areas while 86.49% of hanging cases reported fromrural areas.All hanging cases were suicidal in nature andthose of ligature strangulation were homicidal in nature. In two third of cases, ligature material used was rope. Ligature mark was above thyroid in 73.95% of cases of hanging and below thyroid in75.00% cases of ligature strangulation. Associated injuries were present on other body parts in 7.29% of hanging cases and 54.17% ofligature strangulation.Complete ligature mark was seen in 2.08% cases of hanging and 79.17% cases of strangulation. Fracture of hyoid bonewas seen in 45.83% cases of ligature strangulation and 7.29% cases of hanging. Dribbling of saliva was observed in 39.58% of hanging cases. The study area showed an incidence of hanging of 1.4 per 100000 as compared to a national average of 4.1 per 100000.****Conclusion****: Risk factors and aetiology are multifactorial and multidimensional. High suicidal prevalence rates have considerable implications for health care facilities. Early recognition of risk factors is important for prevention and appropriate intervention.*

Keywords
Hanging, strangulation, asphyxia, death, constriction, neck.

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I. Introduction

Violent asphyxial deaths are one of the importantcauses of deaths observed in medico legal autopsies. Asphyxialdeaths are divided into different methods such as hanging, strangulations (manualand ligature), suffocations (environmental, smothering, choking, mechanical, suffocating gases), chemical asphyxia (carbon monoxide, hydrogen cyanide, hydrogen sulphide), and drowning's.[1]Among which hanging and ligature strangulation cases are commonly encountered in the professional life of forensic expert during day to day autopsy.[2]The ligature mark is the most relevant external sign and its characteristics are well known, but, for unknown reasons, there are major differences in reports on internal finding.[3]Hanging is always considered suicidal except accidental hanging, in sexual perverts, homicidal in lynching and justifiable judicial hanging.[4]It is easy to differentiate hanging and ligature strangulation when one finds the classical features. However, typical features are present very occasionally.[2]

The last 30 years have seen an increase in suicides by hanging, particularly amongst young malesin Australia, New Zealand, and elsewhere. In England, suicide by hanging has increased markedly in males of more than65 yearsof age.[5]In India, hanging was the commonest method of suicide (37%) in 2012. Hangings comprised 13.5% of total unnatural deaths in India.[6]

Public health authorities require accurate, timely, and comprehensive surveillance data to better understand and ultimately prevent the occurrence of violent deaths.

II. Material and Methods

A retrospective study of deaths due to hanging and strangulation was done by collection of data from medico legal autopsies conducted in the mortuary of our tertiary care institution from 2008 to 2013. The data was collected from police requisition form, post-mortem report. Out of a total of 3264 autopsies during the five-yearperiod, 126 cases were of hanging and strangulation.

III. Observations and Discussion

In the present study, the incidence of cases of hanging and strangulation was 3.86% (n=126), out of the total 3264 autopsies over a five year period ofMay 2008 to May 2013.(Table 1) The finding is similar to studies done at Pakistan[4](4.83%), Chandigarh[7](India)(3.56%) and close to study done in Turkey[1](7.71%) andGujarat (India)[2](8.62%). Use of hanging as method of suicide is largely governed by sociocultural norms of acceptability. Hanging is a predominant method of suicide in most countries.

Among the 126 cases, the incidence of cases of hanging and ligature strangulation was 95.23%, this is more than the findings of study done at Pakistan[4] (77.22%) and Turkey[1](73.17%). Males constitute 82.54%(n=104) which is incontrast to study done at Turkey[1] (60.96%) and Pakistan[4](52.47%)and females constitute17.46% (n=22)which is close to finding of study done at Turkey[1](12.19%) and more than Pakistan[4](34.65%).

Among all, the number of cases of hanging was 96 (76.19%), and ligature strangulation 24(19.04%).(Table 1) The finding is consistent with study done in Turkey[1] (Hanging 68.29%, ligature Strangulation 4.87%), Cuttack[8](India)(Hanging 95.53%,Strangulation 2.60%) and in contrast to Pakistan[4](Hanging 54.45%, Strangulation 23.76%). In our study, there were two cases of manual strangulation, two cases of suffocation and two cases of traumatic asphyxia.

Out of 96 cases of hanging, 78 (81.25%) were males and 18 (18.75%) were females. (Table 1) There are different studies in the literature, which show that mortality due to hanging was more common among males- in Turkey[1](Males 83.93%,), Australia[9] (Males 88%) and Pakistan[4] (Males 72.22%)but thefinding in contrast to study done at Cuttack[8](India) where number of females (62.26%) were more than males (37.74%). Hanging is a selective method which is violent, needs preparation and some degree of courage and determination; apart from the concept of opportunity structure.

The number of male victims of ligature strangulation was 22(91.66%)(Table 1) which is more than study done at Turkey[1] (75.0%,) and Pakistan[4] (58.33%,) and Cuttack[8](India) (28.58%).Manual strangulation was seen in females only. Strangulation is one of the most lethal forms of personal violence which symbolises the assailant's power and control over the victim.

The highest numbers of cases of hanging were young adults (21-40years, 68.75%). The findings are comparable to study done in Pakistan[4](15-45years, 81.48%), and Australia[9](15-35 years,56%), Turkey[1](mostly 25-30years) while amongst the cases of strangulation highest number was in age group of 31 to 40 years (41.67%) which is in contrast to study done at Pakistan[4] and Cuttack[8](India) in which most common cases of strangulation was in 21 to 30years (71.42%).In a study from New Zealand[10]conducted in 1999, it was reported that young people aged between 15–24 years of suicides by hanging, 65% were male and 75% were female. Males and young age group population between 15–30 years are more vulnerable victims of violent asphyxial deaths. (Table 2)

Hanging mostly occurred during morning (29.17%) and afternoon (22.92%) while most of cases of strangulation occurred during afternoon (37.50%) and night (33.33%). (Table 3)

Most of the cases of hanging and ligature strangulation occurred in winters 37(29%) followed by spring 29(23%), summer 24(19%)and autumn 23(18%), this is in contrast to study done at Turkey[1]in which most of the cases were in summer(35.8%) and spring(26.1%).(Table 4)

Most of the cases of hanging(67.70%) occurred in rural areas which is in contrast to study done at Patiala[11](India)(rural 33.33%)whereas most of cases of strangulation (75%) occurred in urban areas which is close to a previous study done at Patiala[11] (India) (66.67%). (Table 5)

The place of incidence for most of the cases (95.83%) of hanging was home, the finding is similar to finding of study done at Turkey[1](76%) and UK[5](75%).Most of the cases of strangulation(62.50%) occurred outside.(Table 6)

Rope was the most common material used for hanging(66.67%), the finding is similar to study done at Australia[9](59%) andMaharashtra[12] (India)(75%) and UK.[5] Rope was commonly used for ligature strangulation(42.85%)also, the findings are in contrast to study done at Chandigarh[7](India) where soft material like cloth(31%) was commonly used for hanging. Rope is commonest material available at any place, so its use is more.(Table 7)

All the cases of hanging were of suicide and allthe cases of strangulation were of homicide. The findings are similar to findings in study done at Pakistan[4] and Turkey[1] andGujarat.[2] Homicidal hanging deaths are extremely rare. There was no homicidal hanging in this study group, whereas some studies reported homicide both in children[9]and adults. (Table 8)

In 73.95% of cases of hanging, ligature mark was above thyroid cartilage, the finding is close to study done at Gujarat[2](India)(72.09%) and Cuttack[8](India) (61.86%). In 75.00% of cases of ligature strangulation, level of ligature was below thyroid which is more than in study done at Cuttack[8](India) (42.85%) and in contrast to study done at Gujarat[2] (India) in which all were below thyroid. (Table 9)

Ligature, in situ, was found in 6.25% of cases of hanging and 8.33% cases of ligature strangulation. Ligature mark was complete in 2.08% cases of hanging while it was 15% in study done at Chandigarh[7](India) and 79.17% of cases of strangulation. Single turn of ligature mark was present in 98.96% cases of hanging and 75.0% cases of strangulation the findings are similar to study done at Maharashtra[12](India) and Chandigarh[7](India) (93%).7.29% of cases of hanging have associated injuries on other body parts while 54.17% of cases of strangulation have associated injuries on other body parts. Dribbling of saliva was present in 39.58% of cases of hanging, which is consistent with study done at Gujarat[12] (India)(38.37%) and not found in any cases of strangulation. Typical post-mortem staining was present in 21.88% of cases of hanging. Oblique ligature mark was present in 94.79% of cases of hanging which is close to findings seen in study done at Gujarat[2] (India)(100%) and Maharashtra[12](India)(100%) and Chandigarh[7](India) (98%). The ligature mark was oblique in 12.50% cases of ligature strangulation which is in contrast to study done at Gujarat[12](India) and Chandigarh[7] (India) where ligature mark was transverse in all cases. (Table 10, 11, 12)

Hyoid bone fracture was seen in 7.29%of cases of hanging which is consistent with study done at Maharashtra[12] (India)(7.14%),Gujarat[2] (India) (11.63%) and in contrast to study done at Turkey[1](46%). Hyoid bone fracture was seen in 46.4% of cases of ligature strangulation which is in close relation to study done at Maharashtra[12](India) (50%) and in contrast to study done at Gujarat[2] (India) (0%) and Turkey[1] (25%).(Table 10, 11, 12) Post-mortem detection of hyoid bone fracture is relevant to the diagnosis of strangulation. However, since many cases lack a hyoid fracture, the absence of this finding does not exclude strangulation as a cause of death. The reasons why some hyoids fracture and others do not, may relate to the nature and magnitude of force applied to the neck, age of the victim, nature of the instrument (ligature or hands) used to strangle, and intrinsic anatomic features of the hyoid bone.[13]

Injuries on other parts of body were present in 7.29% of cases of hanging which is higher than the study done at Gujarat[2] (India)(1.25%). Injuries on other parts of body were present in 54% of cases of ligature strangulation.(Table 10)

There is steady increase in number of cases of both hanging and strangulation over the years with average 16 cases of hanging per year and average 6 cases of strangulation per year. On correlation of the data relating to hanging cases with the population data[14] it has been noted that the incidence of hanging all over India is 4.1 per lac population where as it is toward higher side in metropolitan cities like Delhi (7.9 per lac) and Chandigarh (7.1 per lac); but it is on a lower side in predominantly rural state like Punjab (1.1 per lac) and its cities like Patiala (1.4 per lac) as determined in this study.(Table 13, 14) Studies have recorded an incidence of 3.1 in USA[15], 4.4 in UK[16], 5.1 in Canada[17], 5 -13 in Transkei region of South Africa[18] and 15.2 in Poland[19]per lac of population. As per data available from WHO mortality data base, hanging as method of suicide varies from a low of about 10% in El Salvador and Peru to a high of about 90% in Kuwait, Lithuania and Poland.[20]There are substantial differences in the pattern of suicide methods internationally. The WHO study suggests that there is a degree of underreporting of suicides which varies between countries and that the mortuary based violent death studies can be a useful indicator.

IV. Conclusion

Males and young age group population are more vulnerable victims. The ligature mark is the most relevant external sign in both hanging and ligature strangulation. The frequency and distribution of injuries to neck and other body parts is important to differentiate between hanging and ligature strangulation. Most importantly a complete examination of the ligature mark is must to differentiate between the two. The importance of proper post-mortem external and internal examinations is obvious. Most of the time autopsy surgeon has to rely upon the ligature mark and circumstantial evidence. The difficulty in detecting strangulation is a challenge for law enforcement and medical professionals, which makes it particularly useful means of intimidation and harm.

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Table 1. Distribution of cases of violent asphyxial deaths

Cause of death / Sex of victim	Male		Female		Total no. of cases	
	No.	%	No.	%	No.	%
Hanging	78	75.00%	18	81.82%	96	76.19%
Strangulation	22	21.15%	2	9.09%	24	19.05%
Manual strangulation	-	-	2	9.09%	2	1.59%
Suffocation	-	-	2	9.09%	2	1.59%
Traumatic asphyxia	2	1.92%	-	-	2	1.59%
Total	104	82.54%	22	17.46%	126	100.00%

Table 2. Age distribution of cases of hanging and ligature strangulation

Age group (years)	Hanging		Ligature Strangulation		Total	
	No.	%	No.	%	No.	%
< 21	17	17.70%	2	8.33%	19	15,83%
21-30	34	35.42%	4	16.67%	38	31.67%
31-40	32	33.33%	10	41.67%	42	35.00%
41-50	11	11.45%	4	16.67%	15	12.05%
51-60	-	-	2	8.33%	2	1.67%
>60	2	2.08%	2	8.33%	4	3.33%
Total	96	100.00%	24	100.00%	120	100.00%

Table 3. Time of occurrence of cases of hanging and ligature strangulation

Time period of day	Hanging		Ligature Strangulation		Total	
	No.	%	No.	%	No.	%
6-12 am (morning)	28	29.17%	2	8.33%	30	25.00%
12-6 pm (afternoon)	22	22.92%	9	37.50%	31	25.83%
6-9 pm (evening)	18	18.75%	3	12.50%	21	17.50%
9-12 pm (night)	16	16.67%	8	33.33%	24	20.00%
12-6 pm (late night)	12	12.50%	2	8.33%	14	11.67%
Total	96	100.00%	24	100.00%	120	100.00%

Table 4. Monthly distribution of cases

Season	Hanging		Ligature Strangulation		Manual strangulation		Suffocation		Traumatic asphyxia		Total Cases	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Jan	10	10.42%	-	-	1	50%	-	-	-	-	11	8.73%
Feb	11	11.46%	5	20.83%	-	-	-	-	1	50%	12	9.52%
Mar	7	7.29%	3	12.50%	-	-	-	-	-	-	10	7.94%
Apr	4	4.17%	3	12.50%	1	50%	-	-	1	50%	9	7.14%
May	7	7.29%	2	8.33%	-	-	1	50%	-	-	10	7.94%
Jun	9	9.38%	1	4.17%	-	-	-	-	-	-	10	7.94%
Jul	9	9.38%	3	12.50%	-	-	-	-	-	-	12	9.52%
Aug	8	8.33%	1	4.17%	-	-	1	50%	-	-	10	7.94%
Sep	6	6.25%	2	8.33%	-	-	-	-	-	-	8	6.35%
Oct	5	5.21%	1	4.17%	-	-	-	-	-	-	6	4.76%
Nov	8	8.33%	1	4.17%	-	-	-	-	-	-	9	7.14%
Dec	12	12.50%	2	8.33%	-	-	-	-	-	-	14	11.11%
Total	96	100%	24	100%	2	100%	2	100%	2	100%	126	100.00%

Table 5. Area of occurrence

Area of occurrence	Urban		Rural		No. of cases	
	No.	%	No.	%	No.	%
Hanging	31	59.62%	65	87.84%	96	76.19%
Strangulation	19	36.54%	5	6.76%	24	19.05%
Manual strangulation	-	-	2	2.70%	2	1.59%
Suffocation	-	-	2	2.70%	2	1.59%
Traumatic asphyxia	2	3.84%	-	-	2	1.58%
Total	52	100.00%	74	100.00%	126	100.00%

Table 6. Place of incidence

Place of incidence	Hanging		Strangulation	
	No.	%	No.	%
Home	92	95.83%	9	37.50
Outside	4	4.17%	15	62.50
Total	26	100.00%	24	100.00%

Table 7. Ligature material used

Ligature Material used	Hanging		Strangulation		No. of cases	
	No.	%	No.	%	No.	%
Rope	64	66.67%	3	12.5%	67	55.83%
Wire	8	8.34%	20	8.33%	10	8.33%
Bed sheet\other cloth	18	18.75%	-	-	18	15.00%
Chunni	6	6.25%	1	4.17%	7	5.83%
Belt	-	-	1	4.17%	1	0.83%
Unknown	-	-	17	70.83	17	14.17%
Total	96	100.00%	24	100.00%	120	100.00%

Table 8.Manner of death

Cause / Manner of death	Accidental		Homicide		Suicide		No. of cases	
	No.	%	No.	%	No.	%	No.	%
Hanging	-	-	-	-	96	100.00%	96	76.19%
Strangulation	-	-	24	85.72%	-	-	24	19.05%
Manual strangulation	-	-	2	7.14%	-	-	2	1.59%
Suffocation	-	-	2	7.14%	-	-	2	1.59%
Traumatic asphyxia	2	100.00%	-	-	-	-	2	1.59%
Total	2	100.00%	28	100.00%	96	100.00%	126	100.00%

Table 9.Level of ligature mark on neck

Level of ligature	Hanging		Strangulation	
	No.	%	No.	%
Above thyroid	71	73.95%	1	4.16%
At thyroid	25	26.04%	5	20.00%
Below thyroid	-	-	18	75.00%
Total	96	100.00%	24	100.00%

Table 10. Important autopsy features

Autopsy Feature	Hanging (n=96)		Ligature Strangulation (n=24)	
	No.	%	No.	%
Ligature, in situ	6	6.25%	2	8.33%
Complete	2	2.08%	19	79.17%
More than one turns	1	1.04%	5	20.83%
Injuries on other body parts	7	7.29%	13	54.17%
Dribbling of saliva	38	39.58%	-	-
Typical pm staining	21	21.88%	-	-
Oblique ligature mark	91	94.79%	3	12.50%
Hyoid fracture	7	7.29%	11	45.83%

Table 11. Comparison of findings of hangingwith other studies

Hanging	Turkey[1]	Pakistan[4]	Gujarat (India)[2]	Present study
Year	2006	2012	2013	2013
Age	30-39years	15-35years	21-40years	21-40years
Incidence	60.21%	2.58%	-	76.19%
Male sex	87.92%	72.22%	-	81.25%
Season	Summer	-	-	Winters
Place	76% home	-	-	Home
Material	-	-	-	Rope
Level above thyroid	85.7%	-	72.9%	59.38%
Hyoid fracture	46.4%	-	11.63%	7.29%
Other injuries	3.7%	-	1.165	7.29%
Dribbling of saliva	-	-	38.37%	39.58%
Manner	Suicidal 100%	Suicidal 100%	-	Suicidal 100%

Table 12.Comparison of findings of strangulation with other studies

Strangulation	Turkey[1]	Pakistan[4]	Gujarat[2] (India)	Present study
Year	2006	2012	2013	2013
Age	20-40yrs (50%)	15-35years	-	31-40ys (41.67%)
Incidence	7.52%	35.64%	4.44%	19.04%
Sex	Male 28.57%	Male 36.0%	-	Male (99.67%)
Season	-	-	-	Spring (45%)
Place	Outside 57.14%	-	-	Outside (62.50%)
Material	-	-	-	Rope (42.85%)
Level below thyroid	-	-	-	54.17%
Hyoid fracture	57.14%	-	-	46.4%
Other injuries	100%	-	100%	54.0%
Dribbling of saliva	-	-	-	-
Homicidal	71.48%	100%	75%	100%

Table 13. Distribution of cases over the years

Year	Hanging		Ligature strangulation		Total	
	No.	%	No.	%	No.	%
2008	8	8.34%	-	-	8	6.67%
2009	12	12.50%	-	-	12	10.00%
2010	12	12.50%	2	8.34%	14	11.66%
2011	22	22.91%	4	16.67%	26	21.67%
2012	26	27.08%	10	41.66%	36	30.00%
2013	16	16.67%	8	33.33%	24	20.00%
Total	96	100.00%	24	100.00%	120	100.00%

Table 14. Comparison of the data from present study with the national crime data[6]

2012	Population[14]	Hanging cases	Incidenceof Hanging(per lac)	Total suicides	Hangings as percent of suicides	Total Unnaturaldeaths	Hanging as percent of unnatural deaths
India	1210569573	50062	4.1	135445	37%	372022	13.5%
Punjab	27743338	311	1.1	1030	30.2%	9930	3.1%
Delhi	16787941	1332	7.9	1899	70.1%	44691	2.98%
Chandigarh	1055450	75	7.1	114	65.8%	341	22%
Ludhiana	3498739	76	2.2	98	77.6%	478	15.9%
Patiala	1895686	26	1.4	-	-	721	3.6%

Lac =100,000 = One hundred thousand

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