

Study of Violent Asphyxial Death

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ABSTRACT

Background: An increasing death rate as a result of violence constitutes a large group in medico-legal autopsies especially deaths due to asphyxia are one of the most important cause in violent deaths.

Method: It was a prospective study of all medico-legal autopsies performed between December 2008 and November 2010 at mortuary of Civil Hospital affiliated with B.J. Medical College, Ahmedabad, Gujarat, India. Out of the total autopsies conducted at the Mortuary of Civil Hospital, Ahmedabad, those where the victim died as a result of violent mechanical interference with respiration like hanging, strangulation, and drowning were included.

Results and Conclusion: Incidence of violent asphyxia deaths is 5.63% of total autopsies. Hanging (82.48%) is the most commonly encountered violent asphyxia death. Males are most common victims with male:female ratio 1.69:1. Most commonly involved age group is 21-30 years (128 cases forming 32.99% of total) with 200 victims (51.54%) aged 21-40 years. 312 out of 320 cases (97.5%) of hanging were suicidal and rest 8 (2.5%) were accidental in nature. Homicidal hanging is not recorded in present study. All 12 strangulation cases were of homicide, 32 out of 56 (57.14%) cases of drowning were accidental and remaining 24 (42.86%) were suicidal.

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► *Implication for health policy/practice/research/medical education:*
Violent Asphyxial Death

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1. Introduction:

The term asphyxia is defined as “a condition caused by interference with

respiration or due to lack of O₂ in respired air due to which the organs and tissues are deprived of O₂ (together with failure to eliminate CO₂), causing unconsciousness or death”. In mechanical asphyxia the body lacks of O₂ because of some violent mechanical interference with the process of breathing. So, they are also known as violent asphyxial deaths (12).

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Violent asphyxial deaths are of common occurrence and classified as Hanging, Drowning, Strangulation, Suffocation and Traumatic asphyxia. The hanging and drowning are commonly seen in suicidal cases while strangulation including throttling is usually homicidal. In addition to these accidental compression or trauma to chest that prevent in respiratory movement, known as traumatic asphyxia or crush injury is also one of the cause of violent asphyxial death (4, 11).

Due to population explosion, poverty and increasing stress and strain in our daily life, we frequently come across cases of suicides, homicides and accidents. Males and females are both exposed to such stresses but it seem that ours being a male dominated society and more exposure to external environment, such cases are commonly seen in males. With urbanisation, rural areas are also not left aloof and this can be seen from the increasing incidence of such cases from these areas (5).

Considering above facts it is highly essential to diagnose and differentiate between different asphyxial deaths, especially between hanging and strangulation by ligature. In addition to the cause of death, the careful post-mortem can also help the investigator to arrive at a conclusion about manner of death.

The present study is carried out with a view to study to incidence of post-mortem findings in violent asphyxial deaths with regard to key features that help to differentiate between different violent asphyxial deaths. The demographic and socioeconomic factors including preliminaries of the deceased and scene of crime are additional parts of this study which helps to know the incidence of violent asphyxial deaths amongst the people of Gujarat.

2. Materials and Methods:

The present prospective study of violent asphyxial deaths is carried out at Forensic Medicine Department of B. J. Medical College and mortuary of attached Civil

Hospital at Ahmedabad, Gujarat during the two years from December 2008 to November 2010.

A total of 6880 autopsies were carried out during the period. Out of them in 388 cases (5.63 %) the victims had died as a result of violent mechanical interference with respiration like hanging, strangulation, and drowning. These 388 cases were meticulously studied by considering various parameters like preliminaries of the deceased, history and place of incidence, postmortem findings etc. The findings/data were recorded on a specially designed proforma, tabulated and compared with similar studies by other authors.

The present study was conducted to study the incidence, methods adopted, demographic variables and post-mortem findings in violent asphyxia deaths at Civil Hospital, Ahmedabad.

3. Results:

Incidence: Incidence of violent asphyxia deaths is 5.63% of total 388 autopsies in the present study during the two years from December 2008 to November 2010.

This incidence rate is contrast to the incidence rate of study by AzmacD (15.7%), but coincides with studies by Amandeep et al (5.26 %) and by Gargiet *al* (3.9%) (2,5,17).

The incidence classification of different violent asphyxial deaths in studies by different authors compared with the present study is in table 1.

The difference in the incidence rate of different violent asphyxia death is evident from the table 2, because the type of death adopted by people is dependent on the intrinsic peculiarities of population and culture.

Hanging (82.48%) is the most commonly encountered violent asphyxia death followed by drowning (14.43%) and strangulation (03.09%). From all the cases of hanging, possibility of homicidal nature was ruled out. Majorities (97.5%) were suicidal and a few (2.5%) were accidental.

Table 1: It is showing incidence of violent asphyxial deaths.

Total no. of autopsies conducted during the two years from December 2008 to November 2010.	6880
No. of violent asphyxia death	388
Percentage	5.63%

Table 2: Incidence classification of various violent asphyxial deaths.

Cause of death	Present study	Amandeep Singh	Azmak D
Hanging	320(82.48%)	27(24.3%)	56(41.8%)
Strangulation	12(03.09%)	11(9.9%)	41(30.5%)
Drowning	56(14.43%)	66(59.4%)	07(5.2%)
Others	00(0.0%)	07(6.3%)	30(22.5%)
Total	388(100%)	111(100%)	134(100%)

Table 3: Age and sex wise distribution of cases (as known and determined on autopsy).

Cause Of Death	Sex	Age Groups						Total
		0-10	11-20	21-30	31-40	41-50	51-60	
Hanging	M	00	36	68	44	24	20	192
	F	00	40	60	20	04	04	128
Strangulation	M	00	00	00	00	04	00	04
	F	00	00	00	04	00	04	08
Drowning	M	16	12	00	00	04	16	48
	F	04	00	00	04	00	00	08
Total		20	88	128	72	36	44	388
		(5.15%)	(22.68%)	(32.98%)	(18.56%)	(9.27%)	(11.34%)	(100%)

Table 4: Table is showing manner of death.

Cause of Death	Suicidal	Homicidal	Accidental	Total
Hanging	312(80.41%)	00	08(2.06%)	320(82.48%)
Strangulation	00	12(3.09%)	00	12(14.43%)
Drowning	24(6.19%)	00	32(8.25%)	56(3.09%)
Total	336(86.60%)	12(3.09%)	40(10.31%)	388 (100%)

Table 5: Table is showing reason for death.

Reason for Death	Hanging	Strangulation	Drowning	Total
Personal	136	00	00	136(34.51%)
Social/family/ domestic problems	88	00	00	88 (22.68%)
Borrowings	32	00	00	32 (8.25%)
Extramarital affairs/sexual	08	00	00	08 (2.06%)
Revenge	00	04	00	04 (1.03%)
Not known	48	08	24	80 (20.62%)
Accidental	08	00	32	40 (10.31%)
Total	320	12	56	388 (100%)

Age and Sex: Males are most common victims with male: female ratio is 1.69:1. Most commonly involved age group is 21-30 years (128 cases forming 32.99% of total) with 200 victims (51.54%) aged 21-40 years.

21-30 years age group is most commonly affected in the present study (128 cases forming 32.98% of total). In studies by Amandeep *et al* 59.24% case were seen among population of 15-25 years of age. Azmak (Turkey) describes 20.8% victims aged 30-39 years. This young adult group is most active group of population and more exposed to external environment and stress and strain of life (2, 17).

Manner of Death: 312 out of 320 cases (97.5%) of hanging were suicidal and rest 8 (2.5%) were accidental in nature. Homicidal hanging is not recorded in present study. All 12 strangulation cases were of homicide, 32 out of 56 (57.14%) cases of drowning were accidental and remaining 24 (42.86%) were suicidal.

Reason for death: Personal reasons were most commonly noticed for suicide by hanging followed by family problems and borrowings. In 8 cases of strangulation, the reason for homicide was not known. The remaining 4 victim were strangled for the want of revenge. 32 victims drowned accidentally and in 24 cases the reason for death was not known.

It was elicited from the history that personal reasons (136 out of 320 cases) like failure in the examinations, psychiatric problems, long time illness etc. were the most common reasons for suicide by hanging followed by family/domestic problems (88 cases), borrowings (32 cases) and extra-marital affairs (8 cases). In 48 cases the reason for suicide with hanging was not known and 8 victims were hanged accidentally during play. Among 12 cases of strangulation in present study, four victims were killed for the want of revenge, reason for remaining was not known. 32 victims had drowned accidentally and remaining 24 were not known.

Place for Hanging: It can be seen that majority people from urban population of Gujarat State committed suicide by hanging within the closed secure places i.e. at their home rather than at open place like hanging from a branch of tree.

Ligature material: For the purpose of present study the ligature material is divided into two broad groups. 1. Hard – e.g., electric wire, rope, nylon wire etc. 2. Soft – e.g., dupatta, bed-sheet, saree etc.

The use of ligature material in studies of different cases of hanging by different authors is summarized in table 7.

The difference in the studies could be because of fact that suicide is because of an impulse and for that the victim uses whatever material is available nearby on that particular period of time. To conclude it can be said that for a person to end his/her life by hanging, he/she may use any material available in the vicinity (8, 15, 20).

Type of knots in Hanging and Strangulation: The table shows different types of knot used in study.

148 cases out of 320 cases (46.25%) of hanging in present study had fixed knot and 172 cases (53.75%) had running noose. This finding is consistent with study of Vijaynath V *et al*, where 44.45% fixed knot and 52.94% cases with running noose. Sharma B R *et al* has also listed 58.78% cases with fixed knot and 41.22% cases with slip knot (15, 20).

Type of Hanging: Following table shows type of Hanging occurred in present study.

In our study only 4 (1.25%) victims were in partial hanging position (kneeling down) and the rest (316 cases forming 98.75%) were found fully suspended with feet clearly off the ground. Whereas Vijaynath has reported 5.88% victims hanging partially and rest 94.12% were completely suspended.

Recording of typical hanging (2.5% in present study) was inconsistent findings with 23.52% cases in studies by Vijaynath (20).

Table 6: Table is showing place for hanging.

PLACE FOR HANGING	NO. OF CASES
Open place	12 (3.75%)
Closed place	308 (96.25%)
Total	320 (100%)

Table 7: Table is showing ligature material used for hanging/strangulation.

LIGATURE MATERIAL	HANGING (320 cases)	STRANGULATION (12 cases)	TOTAL
SOFT MATERIAL			
Bed sheet	32 (10%)	00	32 (9.64%)
Dupatta	216 (67.5%)	04 (33.33%)	220 (66.26%)
Sarree	04 (1.25%)	00	04 (1.21%)
Piece of cloth	04 (1.25%)	04 (33.33%)	08 (2.41%)
SUBTOTAL	256 (80%)	08 (66.67%)	264 (79.52%)
HARD MATERIAL			
Electric wire	04 (1.25%)	00	04 (1.21%)
Rope	60 (18.75%)	04 (33.33%)	64 (19.27%)
SUBTOTAL	64 (20%)	04 (33.33%)	68 (20.48%)
TOTAL	320 (100%)	12 (100%)	332 (100%)

Table 8: Use of ligature material in hanging cases of different studies.

STUDIES	LIGATURE MATERIAL (in hanging cases)		
	Soft	Hard	Total
Present study	256 (80%)	64 (20%)	320 (100%)
Sharma B R <i>et al</i> (19)	31 (56.36%)	24 (43.64%)	55 (100%)
Naik S K <i>et al</i> (10)	129 (53.97%)	110 (46.03%)	239 (100%)
Vijaynath V <i>et al</i> (24)	70 (70%)	30 (30%)	100 (100%)

Table 9: Type of knot in cases of hanging and strangulation.

TYPE OF KNOT	HANGING	STRANGULATION	TOTAL
Fixed	148	12	160
Running	172	00	172
Total	320	12	332

Table 10: Table is showing type of hanging (out of 320).

On basis of position of knot	Typical	08 (2.5%)
	Atypical	312 (97.5 %)
On basis of degree of suspension	Complete	316 (98.75 %)
	Partial	04 (1.25 %)

External Post-mortem findings of Hanging and Strangulation: Post-mortem findings are conclusive and important to differentiate hanging from ligature strangulation.

The mark on the neck was the principal sign of hanging and ligature strangulation. It was obliquely placed in all the cases of hanging because of suspension of the body

from a higher point and was transversely placed in all the cases of strangulation.

In absence of post-mortem finding attributing to cause of death other than drowning, it becomes necessary to rely on history and circumstantial finding to considering them either suicidal or accidental in nature.

Dribbling of saliva is considered an important finding of ante mortem hanging as secretion of saliva being a vital function which cannot occur after death, was recorded in 228 out of 320 cases (71.25%) of hanging. Whereas Vijaynath *et al* found it in only 31.93% cases (20).

'La facie sympathique'-originally described by Etienne Martin (1950) cited by Polson and Gee was not seen in any of the cases of hanging under present study might be due to manual alteration by relatives or police at the time of inquest preparation.

Internal Post-mortem Findings of Hanging and Strangulation: The appearance of post-mortem findings on internal examination of hanging and strangulation cases are tabulated below.

In all cases of hanging the subcutaneous tissue below the mark was white glistening because of continuous pressure of ligature. 20 cases (6.25%) were showing haemorrhages in the neck muscles compared to 23.52% described by Vijaynath *et al* (20).

Though percentage of hyoid bone fracture in asphyxia by compression of neck cited by many authors as none or less or controversial; they agree that hyoid bone fracture occurs after the age of 40 years (as it is ossifies at age of 40 years) The incidence vary greatly from 0-68 % from author to author when we look into different text as:

- 1) Reutor (1901) – 60% in typical hanging, 30% in atypical hanging (13).
- 2) Smith and Fiddes (1995) – practically never fractured in hanging (19).
- 3) Wintraub (1961) – seen in 27% cases of hanging (21).
- 4) Modi J.P. (1988) – fracture is rare in hanging (6).

5) Mukherjee J.B.(1994) – Not found in 500 cases of hanging (7).

6) Betz P. and Eisenmenger W. (1996) – throat skeleton fracture seen in 67% hanging (3).

7) Nandi A (2000) – does not occur in more than 5-10% cases of hanging (9).

8) Reddy K.S.N. (2000) – Seen in 15-20% cases of hanging but rare below 40 years of age (12).

9) Nikolic, S., Micic, J., Antanasijevic, T., Djokic, V. and Djonic, D (2003) – throat skeleton fracture seen in 68% cases of hanging (10).

Present study has recorded no hyoid bone fracture in any case of hanging which is same as study by Naik S, and Vijaynath has noted 3.36% cases (8, 20).

But surprisingly an interesting finding in the literature reviewed is that fracture of the hyoid bone is also present in young individuals. Simonsen observed fracture of hyoid bone in 30% of cases aged less than 40 years (16).

None of the cases of hanging or strangulation under present study showed fracture of thyroid cartilage or tearing of intima of carotid.

The 12 cases of ligature strangulation under present study were diagnosed by presence of struggle marks, transverse ligature mark below the level of thyroid cartilage, ecchymosed subcutaneous tissues, heavily contused neck muscles and consistent history and circumstantial evidence as available from police.

Level of constriction: Level of constricting force/ligature on neck noted by different authors is compared with the present study as listed in table 13.

Place of Drowning: Table 14 shows different places of Drowning in present study.

24 out of 56 cases (42.84%) of drowning were in running water of river and canal and rests (32 cases) were in static water as described in table 14.

Post-mortem findings in drowning: Table 15 shows post-mortem findings of drowning cases of present study.

Table 11: Table is showing post-mortem findings on external examination in cases of hanging and strangulation.

EXTERNAL FINDINGS		HANGING (320 cases) Oblique (100%)	STRANGULATION (12 cases) Transverse (100%)
Placement of ligature mark			
Place of ligature mark at neck	above thyroid	20 (6.25%)	00
	at & above thyroid	300 (93.75%)	00
	Below thyroid	00	12 (100%)
Congestion of face		248 (77.5%)	12 (100%)
Dribbling of saliva		228 (71.25%)	00
La facie sympathique		00	00
Post-mortem lividity	- typical	56 (17.5%)	00
	-On back	164 (82.5%)	12 (100%)
Ecchymosis along edge of mark		88 (27.5%)	12 (100%)
Discharge of semen		56 (17.5%)	00
Discharge of urine/faeces		44 (13.75%)	00
Struggle marks		00	12 (100%)

Table 12: Table is showing post-mortem findings on internal examination in cases of hanging and strangulation.

INTERNAL FINDINGS		HANGING	STRANGULATION
Subcutaneous tissue	White glistening	320 (100%)	00
	Contused	00	12 (100%)
Fracture of thyroid		00	00
Fracture of hyoid		00	08 (66.67%)
Neck muscle contusion		20 (6.25%)	12 (100%)
Strap muscle rupture		00	00
Intimal tear of carotid artery		00	00

Table 13: Level of constriction at neck by different authors.

Site of ligature	Present study	Naik S K	Sharma B R	Vijaynath V
Above LP*	6.02 %	59.85 %	84.62 %	92.44 %
At LP	0 %	19.70 %	5.5 %	4.2 %
At & Above LP	90.36 %	14.87 %	0 %	0 %
Below LP	3.61 %	5.58 %	2.2 %	0.84 %
Not mentioned	0 %	0 %	7.68 %	2.52 %
Total	100 %	100 %	100 %	100 %

* LP = Laryngeal Prominence (8, 15, 20).

Table 14: Table is showing place of drowning.

PLACE	Number OF CASES
River	16 (28.56 %)
Pond	12 (21.43 %)
Canal	08 (14.28 %)
Gutter	08 (14.28 %)
Bucket	04 (7.15 %)
Water tank	04 (7.15 %)
Well	04 (7.15 %)
Total	56 (100 %)

Table 15: Table is showing post-mortem findings in cases of drowning.

POST-MORTEM FINDINGS	NUMBER OF CASES (out of 56)
EXTERNAL EXAMINATION	
Froth at mouth	40 (71.42%)
Cadaveric spasm	00
Cutis anserine	40 (71.42%)
Washerman's hand/feet	56 (100%)
INTERNAL EXAMINATION	
Mud/water in trachea	56 (100%)
Mud/water in stomach	56 (100%)
Mud/water in small intestine	00
Water in pleural cavities > 100ml	56 (100%)

Typical froth of drowning was seen in 40 cases (71.42%). All cases were having mud/water in trachea and also in stomach. Reddy K.S.N. has observed the presence of drowning media (water) in stomach in 70% cases and in small intestine in only 20% cases. We have not found mud/water in intestine in any of the cases. However, mud/water was noticed in respiratory tract and stomach in all 56 cases (100%). In addition, pleural cavities were showing effusion of malodorous drowning fluid > 100ml in all 56 cases (12).

Most of the authors have considered the diatom test being conclusive test to confirm the ante-mortem drowning as well as the place of drowning. This test is considered most important especially when the dead body is decomposed. However in the present study the post-mortem findings were sufficient to conclude the ante-mortem drowning and were correlating with the history and circumstantial evidences so diatoms test was not applied on any of the case from the present study.

4. Discussion:

An increasing death rate as a result of violence constitutes a large group in medico-legal autopsies especially death due to asphyxia are one of the most important cause in violent deaths.

In present study hanging is the most commonly adopted method of violent asphyxia amongst the people of Ahmedabad. It is well known fact that Indian legislation has also accepted hanging as the means for judicial execution of death sentence, as it is considered to be painless mode of death. Hanging is noticed to be the most common type of violent asphyxial deaths by all the authors except Amandeep *et al*, who has explained the proximity of 'bhakhra canal' in his region for higher incidence of death due to drowning (17).

The trends vary widely according to time, region, age-group, sex and race. The male-female ratio of present study is 1.69:1 (244 males to 144 females). This ratio in the study by Amandeep *et al* is 2.08:1. On deep study Amandeep found that the ratio

was 1.45:1 for hanging, 3.12:1 for drowning, and 0.38:1 for strangulation. This is nearly consistent to our study where males predominate both in hanging and drowning as these are not commonly opted method of suicide by females as compared to poison intake and burning. Also that in homicidal strangulation, female victim involvement is predominant. 'Avis' has explained this by the fact that it becomes easier when physical size and strength of assailant exceeds that of victim (1, 17).

It is considered that the manner of death in hanging is virtually always suicidal and in strangulation it is homicidal in nature. Uncommonly accidental hanging does occur. Homicidal hangings however are generally thought to be highly unusual. Despite some case reports of homicidal hangings, retrospective studies by Azmak (Turkey) have demonstrated that homicidal hangings are virtually non-existent. Our study correlates with this fact where all the hanging cases were either suicidal or accidental and all strangulation cases were homicidal. However, study by Gambhirsinghet *al* has demonstrated homicidal hanging cases. 56 cases did not show post-mortem findings attributing to cause of death other than drowning. This cases were well thought-out to be either accidental (32 cases) or suicidal (24 cases) in nature by taking in to consideration history and circumstantial findings (2, 18). In all the 388 cases of violent asphyxia death under present study, decomposition has not advanced to mask the cardinal signs of asphyxia. So cyanosis (evident as bluish discoloration of nails and lips), petechial haemorrhages, visceral congestion and dark fluid blood were noticed in 100% cases as also by Gambhirsinghet *al*, Patel *et al* and Sarangiet *al* (14, 18,).

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