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Original Research Paper

Nomenclature for Knot Position in Hanging A Study of 200 cases

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Abstract

Hanging is one of the common methods of committing suicide world wide. Position of the knot, in hanging cases is important as it determines the post-mortem findings of the head and face and can also be used to predict the expected autopsy findings. Although hanging has been described in forensic literature since ages, there has been no proper scientific nomenclature for classifying the position of knot in hanging cases. This paper describes a new nomenclature of exact knot position on the neck based on commonly used anatomical landmarks with self explanatory terms of classification, so that it can be understood and used by the autopsy surgeons and the pathologists with ease.

In the present study 200 cases of hanging were studied retrospectively and position of knot is classified according to a newly described nomenclature. The new nomenclature classifies the position of knot into 6 major classes each of which are further subdivided into 3 subcategories thus making 18 different positions on each side of neck. The most common position of knot was found at occipitomastoid region (32%) and the least common position being at mental region (2%).

Key Words: Hanging, Nomenclature, Knot Position

Introduction:

Hanging is caused by suspension of the body by a ligature around the neck having a knot or a loop**.** The position of knot in cases of hanging is one criterion on which other variable findings of hanging are based. The knot position determines the tilt of the head, the presence or absence of saliva and its direction of flow, the obliquity of the ligature mark, etc. The literature describes the hanging on basis of knot position as typical or atypical. Therefore to designate the position of the knot in a scientific manner is important to indicate the constellation of findings dependent on its position.

Material & Method:

In this study 200 cases of hanging were studied retrospectively to locate the position of knot and the subsequent findings based on it.

The position of the knot was ascertained from the presence of ligature material, impression of the knot and direction of the ligature mark on the neck.

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It is classified according to the proposed new scientific nomenclature.

Results:

The age group of study was between 10-65yrs with lowest being 13 years and the highest being 62years. Maximum no. of cases was seen between the age group of 16-25 years (48%). There were 136 males and 64 females in the study. Fixed knot was present in 26 cases (13%), loop in 25 cases (12.5%) and sliding knot was seen in 141 (70.5%) cases. In 8 cases type of knot could not be ascertained. In all cases of hanging by fixed knot the position of knot was higher up i.e. at the classified anatomical landmark or at the supra position. The sliding knot or the loop was found to constrict the neck at level lower (sub) to the anatomical land mark. The incidences of various knot position has been depicted in table 1.

Discussion:

In a case of hanging, the knot is that point of ligature around the neck where maximum force of traction occurs and the part of ligature diagonally opposite to the knot bears the maximum body weight thus exerting maximum pressure on underlying neck structures. The sequential pressure including tractional force from maximum pressure to minimum on particular structures like trachea and larynx, jugular veins, carotid and vertebral arteries, neck muscles, thyroid cartilage, hyoid bone, vertebral column and other adjacent structures are

determined by the position of the knot and the type of knot. The knot position determines whether the effects of pressure/traction are unilateral or bilateral. The mechanism of death and the autopsy findings of the neck and above it are also primarily dependent on the position of the knot. Inconsistency in knot position and the direction of flow of saliva or other body fluid suggests suspicious death and foul play.

At present, there is no scientific nomenclature for classification of knot position in the ligature around the neck in hanging cases. The literature mentions only about typical and atypical hanging based on position of knot on the occiput or otherwise [1-4]. Few texts have mentioned about the position of knot being at the angle of mandible, mastoid, occiput or below chin or on either side of neck [5-8] but no proper classification have been mentioned.

I Morild [9] classify hanging as typical-complete, typical-incomplete, atypical-complete, and atypical-incomplete. P Betz and W Eisenmenger [10] have made an attempt at assigning the location of knot scientifically, dividing the possible positions of the knot around the head into four quadrants and at four sites, denoting these sites by roman numbers.

In the proposed new nomenclature the position of knot has been assigned in relation to the anatomical landmarks and the post mortem findings are consequent upon the position of knot. The head and neck has been divided into six segments based on anatomical landmarks, covering the whole circumference of the neck and adjoining part of head and face. Each segmental position has been further divided and prefix sub- and supra- added to indicate the position of knot, and cover all possible location of the knot. (Fig1)

1. **Mental position of the knot:**

The knot is situated over the chin in midline or just right or left to the midline. When the knot is on the under surface of lower jaw or in the neck, it is sub mental and when above the chin, it is supra mental. In supra mental position, the knot impression may not be present as the knot does not touch the skin. The chin is directed upwards and anteriorly causing upward inclination of the face. The saliva may not dribble out but gets collected in the oral cavity and may come out when the body is laid on the ground. Maximum weight of the body is borne by the posterior part of the ligature on the back of the neck. Larynx and trachea do not get completely and/or suddenly compressed and occluded.

Death usually occurs due to cerebral anoxia, venous congestion, asphyxia due to backward fall of tongue, fracture of cervical vertebrae when associated with sudden drop or combination of two or more of them. Hypostasis will be seen on the posterior aspect of face and hence the face may appear normal rather than congested.

The Proposed Nomenclature for the Knot Positions in Cases of Hanging:

	Position of the knot	Subtype
1.	**Mental**	Mental Sub mental Supra mental
2.	**Mandibular**	Mandibular(Left/Right) Sub Mandibular Supra mandibular
3.	**Mandibulo mastoid or Auricular**	Mandibulo-mastoid or Auricular (Left/Right) Infra Auricular or Infra Lobular Supra Auricular
4.	**Mastoid**	Mastoid or Retro-Auricular (Left/Right) Infra Mastoid Supra mastoid
5.	**Occipital or Occipito Mastoid**	Occipital or Occipito- Mastoid (Left/Right) Infra Occipital Supra Occipital
6.	**Mid Occipital**	Mid-Occipital Infra Mid Occipital Supra Mid Occipital

The supra mental position of knot is rarely fatal because the head slips out of the noose and the constriction around the neck is loosened very soon , but when it is associated with double circle of loop around the neck, it causes constriction of neck by the loop.

2. **Mandibular position of knot:**

The knot is situated between the chin and the angle of mandible just over the lower border of mandible. When it is on the under surface of the lower jaw or on the neck, it is sub mandibular. When it is on the surface of the cheek over the body or ramus of mandible, it is supra mandibular and may or may not touch the surface of the cheek.

The chin in mandibular position of knot is directed towards the side of the knot and slightly upward and the head is tilted opposite to the knot. Saliva dribbles out from the angle of mouth opposite to the knot and may flow downwards and laterally on the skin surface towards the angle of mandible before dropping on the body or clothing. Tongue deviates to the side of tilt of the head and may or may not protrude out. Hypostasis on the face will be on the side opposite to the knot.

3. **Mandibulo mastoid or Auricular:**

The knot is situated on lateral aspect of the neck between the angle of mandible and mastoid process. When it is below the ear lobule or in the region of neck, it is called infra auricular

or infra lobular, when l over the pinna, called auricular and when above the pinna, called supra auricular.

In supra auricular knot, the impression of the knot may not be seen. When the knot is sliding, it is usually situated below the ear lobule and when fixed, usually over or above the pinna. The head is tilted opposite to the knot; the saliva dribbles out from the angle of mouth opposite to the knot. The line of flow of saliva is almost parallel to the line of suspension.

4. **Mastoid**

The knot is situated over the mastoid process or in the mastoid region. When it is situated below the mastoid region in the neck, it is sub mastoid and when above the mastoid, it is supra mastoid. In supra mastoid position, the knot impression is usually not seen. Sometimes faintly seen or partly seen because of the presence of scalp hair or because it is not touching the scalp.

5. **Occipital or Occipito Mastoid:**

The knot is situated between the posterior midline and the mastoid process on occipital region called occipital position. When it is below the occipital region at the nape of the neck, it is called infra occipital and when above the level of occiput and not touching the head, it is supra occipital. Saliva flows from lower half of the lip close to the lateral angle of the mouth, from the side opposite to the knot. It may drop on the clothes or the chest and not flow up to the lower border of mandible. This was the most common site of knot position found in our study (32%)

6. **Mid Occipital:**

The knot is situated in posterior mid line. When it is situated below the occiput, it is called infra mid occipital and when over the occiput, it is called supra mid occipital. The head is tilted anteriorly and downwards and the chin is directed downwards and posteriorly. Saliva in such cases flows from the lower lip downwards and may not flow over the chin before it drops on the clothes or the body surface. The direction of ligature material near the knot is inverted 'V' and limbs of this 'V' may be visible very clearly, faint with impression with knot or may or may not be visible in case of supra position of knots because in such cases the knot is situated above landmark and hence neither the knot nor the limb are clearly evident in ligature mark.

Conclusion:

The present nomenclature for assigning the knot position in cases of hanging if applied offers the exact location of the knot in reference to the anatomical bony landmarks and also predicts the associated autopsy findings on the head and neck and the possible mechanism of death. Any gross inconsistencies in this regard would serve to indicate foul play or the presence of suspicious circumstances.

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Table- 1: Incidence of various knot position

Position of knot	Right	Left	Midline	Total
Mental	-	-	1	1
Supra	0	0	1	1
Sub	0	0	2	2
Mandibular	2	1	-	3
Supra	6	5	-	11
Sub	2	4	-	6
Mandibulo-mastoid	4	5	-	9
Supra	5	3	-	8
Sub	20	9	-	29
Mastoid	2	4	-	6
Supra	9	1	-	10
Sub	15	16	-	31
Occipitomastoid	3	3	-	6
Supra	1	2	-	3
Sub	21	34	-	55
Occipital	0	6	8	14
Supra	0	0	0	0
Sub	3	2	0	5

Fig-1: Various Knot Position According to the Newly Proposed Nomenclature