



Homicide by Hanging: a Comprehensive Review of Published Literature

Oktavinda Safitry^{1,2*}, Afid Brilliana Putra², Jatmiko Gustinanda²,
Muhammad Ilham Dhiya Rakasiwi²

¹Department of Forensic Science and Medicolegal, Dr. Cipto Mangunkusumo National General Hospital, Jakarta, Indonesia, 10430

²Faculty of Medicine, Universitas Indonesia, Jakarta, Indonesia, 10430

*Corresponding author e-mail: oktavinda.safitri@ui.ac.id; idhoen@gmail.com

Abstrak

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Pembunuhan dengan cara digantung termasuk jarang terjadi dibandingkan dengan jumlah kasus gantung diri. Tinjauan literatur ini merangkum bukti patologi forensik tentang kasus pembunuhan gantung yang telah dipublikasikan di berbagai jurnal. Pencarian sistematis dilakukan di lima *journal database* hingga diperoleh 12 laporan kasus. Semua artikel lolos kriteria seleksi menggunakan borang telaah kritis laporan kasus dari JBI. Sebanyak empat belas korban dilaporkan memiliki latar belakang psikososial terkait konflik rumah tangga. Reef knot menjadi jenis simpul yang sering ditemukan. Hasil otopsi beragam antar penelitian, beberapa di antaranya melaporkan laring, tiroid, dan tulang rawan hyoid yang utuh. Hanya satu kasus yang menyebutkan patah tulang rawan tiroid. Selain jejas jerat, ditemukan tanda kekerasan lainnya seperti memar, lecet, luka tusuk, dan kekerasan seksual. Dari hasil analisis toksikologi, hanya 3 kasus yang melaporkan alkohol dalam serum korban. Tidak ada ciri-ciri khas yang membedakan cedera leher eksternal atau internal akibat pembunuhan gantung. Dibutuhkan otopsi menyeluruh dan pendekatan holistik dengan mempertimbangkan karakteristik demografis, lokasi penemuan korban, riwayat sosial dan psikiatri, karakteristik jerat, tanda-tanda kekerasan dan analisis toksikologi.

Kata kunci:

Gantung; Pembunuhan; Jerat; Patologi Forensik; Autopsy.

Abstract

Homicide by hanging is a rare incident and, in contrast to suicidal hanging cases, only limited number of homicidal hanging cases have been reported. This comprehensive review is conducted to summarize the published forensic pathology evidence in homicide by hanging. A systematic search in five journal databases resulted in 12 case reports. All articles passed the selection criteria and were appraised using JBI critical appraisal worksheet for case reports. Fourteen victims were reported which in most of the cases psychosocial background were reported. Domestic violence was the common background. Reef knot was the majority knot being used. The autopsy findings vary in the studies, some of which reported intact larynx, thyroid, and hyoid cartilage. Only one case mentioned thyroid cartilage fracture. In addition to the ligature mark, other violence findings include bruises, abrasions, stab wounds, and sexual violence. Toxicological analysis was limited, only 3 case reports reported alcohol in the victim's serum. There are no distinguishing features in the external or internal neck injuries attributable to homicidal hanging. A thorough autopsy and holistic approach should be considered. They are including demographic characteristics, location of the victim, social and psychiatric history, ligature's characteristic, signs of violence and toxicological analysis.

Keywords:

Hanging; Homicide; Ligature; Forensic Pathologist; Autopsy

1. INTRODUCTION

Hanging is the most common method of suicide in the world, with a case fatality rate around 69—84%, slightly lower than the shooting causes [1, 2]. Several identified factors have related to suicide by hanging. They are poor education, unemployment, domestic and financial problems [3–6]. Unlike suicides, homicides by hanging cases are rarely reported and its number is still small. Because of the autopsies were not routinely performed, the number of undetected cases might be higher [7].

Currently, there is no systematic review summarizing the typical characteristics of homicide by hanging. The determination of cause of death in homicidal hanging is difficult and yet challenging because evidence of murder is disguised by hanging the victim to make it look like suicidal hanging. Therefore, a careful autopsy is needed to recognize the signs that might be retrospective pointers towards homicidal hanging [8, 9]. Cordner et al (2020), have published a similar systematic review about suicidal strangulation. Nevertheless, that study specifically addresses strangulation as a cause of death.

This review was written to summarize clinical manifestations, pathological findings, psychological background and other relevant supporting aspects from various case reports and case series. The parameters collected could also

be a standard guidance and minimum component for each expert who want to report a homicidal hanging case.

2. METHODS

Before conducting literature searching, we ensure this study does not duplicate other similar articles at the International Prospective Register of Systematic Review (PROSPERO) database. The design of this study is a systematic review based on *Preferred Reporting Items for Systematic Reviews and Meta-analyses* (PRISMA) flowchart as shown in **Figure 1**.

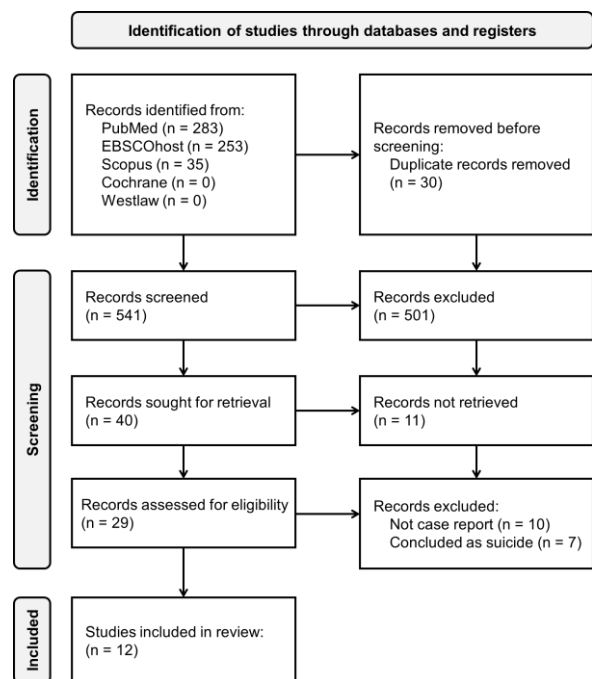


Figure. 1 PRISMA flowchart for systematic review

2.1. Definition of homicide by hanging

Hanging is a form of blunt trauma to the neck. The force exerted on the neck is coming from body weight and gravity force of body parts. In the case of murder, the

hanging is done by the perpetrator and the victim has no intention to attempt suicide [11]. Homicide by hanging means the hanging as a method of killing and/or the hanging as a method to disguise the crime evidence.

2.2. Inclusion and exclusion criteria

The selection of studies included in this report was based on inclusion criteria and exclusion criteria. The studies included in the report were: (1) type of case report/case series study; and (2) homicidal hanging cases or the researcher suspects that the case is homicidal hanging. The studies were excluded if they met one of the following criteria: (1) articles in languages other than English; (2) articles whose full texts were not available; and (3) case series or case reviews that did not provide individual case reports.

2.3. Searching and selection strategies

The strategies used in writing this review:

- (1) Literature searching was carried out in the following journal databases: PubMed, Scopus, EBSCOhost, Cochrane, and Westlaw from 7 to 10 May 2021. The keyword used were “homicidal hanging” and its synonyms.
- (2) Manual search based on the reference list or bibliography on selected articles from the journal database mentioned above.

- (3) All articles were critically appraised by using The Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Case Report [12]. This critical appraisal was conducted for risk of bias or qualitative quality assessment.

2.4. Data extraction

The data summarized in this review are demographic characteristics of the victim, body discovery location, social and psychiatric history, ligature’s characteristic, autopsy results, and neck injuries. The authors also collected additional data to increase the evidence value of the homicide, such as signs of violence or defense, toxicological analysis and the results of investigations or court decisions. Then, all findings are written in a narrative synthesis.

3. RESULTS AND DISCUSSIONS

The study selection followed PRISMA flow diagram 2020. All studies that met the search terms were appraised using the JBI critical appraisal worksheet for case reports (provided as supplementary files). They are valid and importance for included in this review. The reasons for exclusion are shown in **Figure 1**. From the literature searching, there were 12 case reports/series that reported 14 homicidal hanging cases along with the results of the victim's forensic examination [13, 14, 23, 24, 15–22]. The details of each study provided in **Table 1**.

Table 1. Study characteristics

Author (year)	Study design	Case location	Age	Gender	Photographic documentation
Lew (1988) [17]	Case report	Canada	2.5 yo	Male	Available
Vieira (1988) [18]	Case report	Portugal	29 yo	Female	Available
Cooke (1988) [19]	Case report	Australia	8 yo	Female	Available
Abeyasighe (2009) [24]	Case report	Sri Lanka	26 yo	Female	N/A
Ruwanpura (2010) [21]	Case report	Sri Lanka	32 yo	Male	Available
Sharma (2011) [16]	Case report	India	<i>Young*</i>	Male	Available
du Plessis (2012) [15]	Case report	South Africa	<i>Adult*</i>	Female	Available
Sieswerda-Hoogendoorn (2014) [23]	Case report	Netherlands	3 yo	Female	Available
Behera (2015) [22]	Case report	Austria	26 yo	Female	Available
Monticelli (2015) [13]	Case report	Slovak	45 yo	Female	Available
			51 yo	Male	
Zummerova (2015) [14]	Case report	India	3.5 yo	Female	Available
			2 yo	Male	Available
Geisenberger (2019) [20]	Case report	Germany	43 yo	Female	Available

* = Age is not stated; N/A = Not Available.

3.1. Demographical characteristic

The victim's age ranged from 2 years to 45 years (Mean: 20 yo, Median: 26 yo [13, 14, 17–24]; two studies did not mention specific age [15, 16]).

Case reports were published in the range of 1988 to the latest report in 2019. Two case reports occur in India [16, 22], and the others are from Sri Lanka (n=2) [21, 24], Slovakia (n=1) [14], South Africa (n=1) [15], Canada (n=1) [17], Portugal (n=1) [18], Australia (n=1) [19], Germany (n=1) [20] and Netherlands (n=1) [23].

Regarding the demographical characteristics, Godin et al.[25] reported based on gender, the incidence of cervical spine fractures in homicide by hanging in men was associated with heavier pattern and degree of the calcification process compared to women. However, in several other studies

summarized by Godin et al. a higher fracture incidence occurs in women and in several other, no significant difference between the sexes. Furthermore, he also concluded that the incidence of cervical spine fracture increases with age due to the calcification process as this condition makes the neck bones become brittle in old age.[25]

3.2. Victim's body discovery location

The entire case report describes the location where the victim was found. Most of the locations found are in the victim's residence (house or apartment) (n=10) [13–15, 17, 18, 20–24]. While the other 2 cases were found in the well [16] and in the bush [19]. Based on the body position, the victim was found in a fully hanging position (n=8). Two cases explain the position of the victim's body hanging partially on the door

handle [13], one case was found in a lying position [18]. Photographic documentation of the victim's location is included in the report (n=10) [13–22]. The condition that leads to the suspicion of murder is that the perpetrator's body is found near the victim / dyadic death (n=3) [15, 17], signs of violence (n=9) [13–16, 18–21, 24], and the drag marks on the ground (n=1) [16]. None of the case reports have any clues leading to suicidal hanging.

The findings in this review differ from the study of Abouhashem et al. which stated that the victim's location of homicidal hanging is more located outside the house than suicidal hanging [8]. He argues that the victim will choose a safer and more closed location in suicidal hanging cases, while in the case of homicidal hanging, it can occur anywhere according to the wishes of the perpetrator [8]. Ten cases revealed the perpetrators and the victims were from the same household, thus it made the victim's residence becoming the most common location of cases.

3.3. Psychiatric and social history

Social history was assessed in 10 of 12 cases. Domestic problems are described in 8 cases, 3 cases of which are children of problematic parents [17, 22, 23]. One report is a business problem between families [24] and one other report is a kidnapping case [19]. The other 2 cases did not describe

either the social history of the perpetrator or the victim [16, 23].

History of psychiatric disorders was described in 5 of 12 cases [15, 17, 20, 22, 23]. In 2 cases, the perpetrator had a history of depression and one of them had attempted suicide [15, 22]. In the other 2 cases, the perpetrator had a psychotic disorder and a history of treatment in a psychiatric hospital [17, 23]. In one case, the perpetrator had a paranoid personality disorder which led to a divorce from the victim [20]. The psychosocial history in the homicidal hanging case was found to be closely related to the presence of another person as the perpetrator or the trigger of the murder (e.g., in the case of infidelity). This is different from suicidal hanging, which is mostly related to a personal matter. Therefore, upon finding the corpse of a hanging victim, it is advisable to conduct a psychosocial history tracing of the perpetrator to find the possibility of homicidal hanging.

A case report of dyadic death by Zummerova et al. showed that violence can happen to the closest people without being noticed by others. The perpetrator was in a desperate stage, so he decided to commit a homicidal hanging. After that, he regretted and had no hope after seeing the person closest to him die, so he decided to commit a suicidal hanging [14].

3.4. Ligature characteristic

The characteristics of the ligature are asymmetrical diagonal shape [13, 15–18], completely around the neck or closed ligature [13, 14, 20]. The apex's location of the ligature varies (the illustration is shown in **Figure. 2**), starting from the projection in the right external auditory canal [13], left side neck [14], left side of occiput [15], right side of occiput [16], exact behind the head [17–19].

Ligature knots are usually reef knots, except in the case report by Geisenberger et al. which is a slip knot [20]. Ligature's location is specifically mentioned at $\frac{1}{3}$ upper neck in case report by Du Plessis et al. [15], and above the thyroid cartilage in 2 case reports [16, 18].

Ligature materials used vary, there are electrical wires [13, 17], plastic strap/rope [14], nylon [15, 18, 20, 21, 23], cotton or wool [16, 19, 22] and metal wire [24]. According to Abouhashem et al. the location of ligature's knot in the homicidal

hanging cases can be found on the left, right, and occiput sides with the same incidence. The materials used also vary, but the most widely reported is metal wire. This finding can be related to hanging locations, which are mostly outside the house. Therefore, the perpetrator uses objects found at that location [8].

3.5. Neck autopsy findings

On examination, several dry blood spots or abrasions were found around the ligature [13]. Minor abrasions of the neck skin are found on the anterior side of the neck, in the form of a colon (double dot) and a crescent lesion [20], and redness around the scar due to subcutaneous bleeding [24]. The width of the ligature varies from 0.5–3 cm [20, 22, 23]. The majority of ligature injuries encircle the neck completely [13, 14, 20, 22, 23], one partially circular [22] and one is inverted "V" [24].

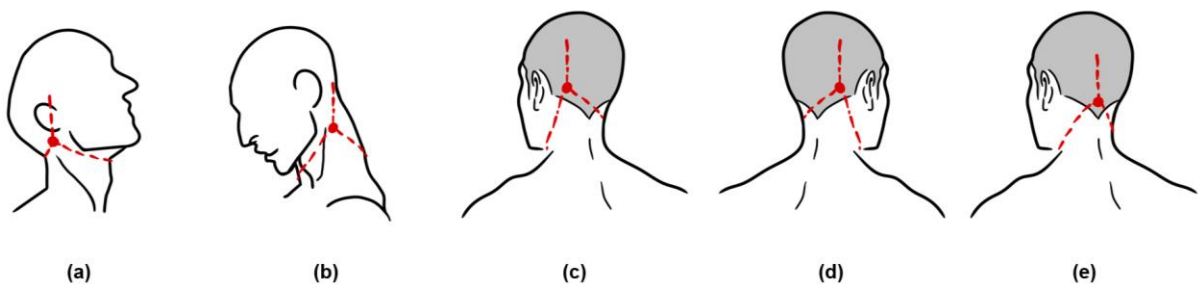


Figure. 2 Illustration of the ligature's apex location and its projection from selected articles (a) right external auditory canal; (b) left side neck; (c) left side of occiput; (d) right side of occiput; (e) exact behind the head.

Based on autopsies in 6 case reports, the larynx, hyoid cartilage, and thyroid structures were intact, with no fractures or bleeding. No relevant bleeding was found in the neck muscles, no visible internal ligature [13, 15, 20–23], and internal carotid interna was intact [15]. Pathological findings at autopsy were contusions and hematomas in the neck muscles [14], neck muscle bruise [24], hematoma at sternocleidomastoid muscle [20], blood accumulation in the left and right soft tissues of the neck [18, 20], ligature lesion in the larynx [17], blood in the right carotid sheath and right trachea [18], blood in the trachea [20], thyroid gland congestion [21], lymph node and salivary gland congestion, tongue base and tracheal mucosal congestion [22].

Until now it is still difficult to compare the results of autopsies on homicide by hanging with other hanging cases (suicidal or accidental). Godin et al. reported that fractures of the cricoid or thyroid cartilage can occur in the homicidal hanging [25]. However, in this review, there was only one report that mentioned thyroid cartilage fracture [20]. Travis et al. mentioned that the fracture is very likely to be affected by the force load [26]. It takes a force of about 18.8 kg to cause a fracture of the cricoid cartilage. Meanwhile, it takes a force load of 14.3 kg to cause a fracture of the thyroid cartilage. Unfortunately, the victim's weight is not mentioned in the various case reports. The absence of a

fracture is still very likely due to the lightweight of the victim [26]. Discussion on the relationship between body mass index and forensic findings on the necks of hanging victims is very limited.

Sundal et al. investigated the relationship between body mass index (BMI) and the incidence of petechiae on the neck of hanging victims [27]. According to the traditional theory, higher BMI should add compressing force to the neck with higher risk of both venous and arterial compression and lower frequency of petechiae. A retrospective study showed no relationship between BMI and petechiae incidence, but when considering the type of hanging that occurred, there was an association between BMI and petechiae incidence in incomplete hanging [27]. Clement et al. investigated the relationship of variables related to the incidence of fractures in the neck structures. This study showed that weight ($t = 4.38$; $p < 0.001$) and BMI ($t = 3.84$; $p < 0.001$) were associated with fractures of the neck structures. Comparison with age as a covariate also still shows significant results [28]. When viewed from the type of hanging, the incidence of fractures did not vary significantly with the type. We suspect that in the homicide case, the killer positioned the rope more carefully so that it was in a higher position than the suicide condition. When compared with suicide cases, thyroid fractures are not always found, considering that these

fractures also depend on the rope material that hangs the victim. Considering that it is weight that pulls the hanging ligatures, it makes sense that tall, heavy, and overweight people are more prone to fractures of the neck structures.

Geisenberger et al. mentioned that autopsies often fail to lead to a homicidal hanging conclusion [20]. The decreasing number of autopsies in developed countries has an impact on the experience and ability of forensic pathologists to suspect the possibility of homicidal hanging. Other contributing factors are the lack of literature on homicidal hanging, knowledge bias, a higher incidence of suicidal hanging than homicidal hanging, and concerns about legal issues (considered unreasonable and a waste of legal resources to find the perpetrator) [20].

3.6. Violence signs

Signs of violence found in hanging murder cases vary, from the presence to the absence of signs of violence [17, 22, 23]. The most-reported violence is blunt force, which causes abrasions to bruises. Bruises and abrasions can be found on the head and face region [15, 18, 21], neck [14, 18], chest and breast [13, 14, 18], abdomen and waist [18, 20], upper extremities [13, 16, 20, 22] and lower extremities [13, 14, 18, 20, 21]. The finding of a left arm fracture was only reported by Vieira et al [18]. Only two case reports describe sharp violence [14, 19]. In

the case report by Zummerova et al. sharp wounds were found on both fingers [14]. While Cooke et al. reported three stab wounds below the umbilicus: one stab wound penetrated the peritoneal space and caused omental bleeding, two stab wounds confined to the subcutaneous fat. There were also ten cuts on the victim's scalp with the edges of the skin peeling off like a cut's wound [14, 19].

Only one case report mentioned sexual violence [24]. Bruises were found on the labia majora and labia minora of rape victims with multiple tears on the inferior side. Fresh tears were also found in the annular hymen at 7 o'clock [24]. Other signs of violence were mouth gagging and hand ties [15].

If there was a fight between the perpetrator and the victim before hanging, then it is possible to find signs of violence on the victim's body. However, signs of violence do not always lead to murder, because in cases of suicide there can also be signs of violence. Signs of violence can also appear when the victim's body has hung and then hit the objects around it, when the victim's body is lowered by officers, or even as a result of resuscitation procedures [18, 29].

3.7. Toxicological analysis

In most case reports, toxicological analyzes were not reported [15, 17–19, 22, 24] or no substance is found in the blood [13,

20, 23]. Three studies reported the presence of blood alcohol content [14, 16, 21]. The toxicological examination has not been widely reported in cases of homicidal hanging. Based on study by San Nicolas et al. alcohol is the first rank of 10 toxicological substances that are commonly found in suicidal hanging [30]. There are no studies discussing the toxicological findings in homicidal hanging. However, alcohol consumption before death leads to decreased inhibitory abilities and increased impulsivity to take high-risk actions. In this review, positive blood alcohol was found in dyadic cases. Blood alcohol content was also found in a case where the perpetrator had a close relationship with the victim. Before being killed, the victim was invited to drink alcohol together. Then, the victim becomes unconscious and does not fight back when killed by hanging [30].

3.8. Victim's death investigation results

The autopsy findings are generally consistent in explaining the victim's death caused by asphyxia due to hanging. Some of the events that preceded the hanging were acts of weakening the victim using alcohol [14, 21], violence [14, 21], or involving more than one perpetrator [21, 24]. Many cases report a difficult investigative process due to confusion over the possibility of suicidal hanging [13, 15, 21]. Cases of dyadic death are also often found in homicidal hanging [14, 15, 17, 22]. The

surviving perpetrator is sentenced to life in prison, and a minimum of 18 years [13, 18, 20].

Possible challenges can be found in proving homicidal hanging in dyadic death cases because the perpetrator has died from suicidal hanging. However, in other cases, the perpetrator was arrested because he had a close relationship with the victim, was near or around the location where the victim was found, or even gave a statement and act like he was the witness who found the victim first. The foresight of the investigator is needed to ascertain the strength of the alleged perpetrator's alibi. So that the case of homicidal hanging is not mistakenly concluded as suicidal hanging.

3.9. Limitation of study

All selected articles are case report studies with low levels of evidence. Each case report does not always display complete demographic characteristics, psychiatric and social history, violence signs, toxicological analysis, and final investigation results. The case report study design also makes quantitative analysis (meta-analysis) unable to be presented in this review. However, this review is the first comprehensive review that discusses homicide by hanging. The selected articles have met the JBI critical appraisal worksheet, so this review can be useful as evidence-based practice when conducting examinations or investigating the next

homicidal hanging case. All parameters collected in this review can be used as a checklist for the completeness of reporting homicidal hanging case illustrations in the future.

4. CONCLUSIONS

Conclusions of homicidal hanging based solely on external examination and autopsy results are difficult. Nonetheless, we recommend that external examination and autopsy be performed in all cases of unnatural death. Homicidal hanging cases are prone to be considered as suicidal hanging. Therefore, forensic pathologists should consider several other aspects, starting from the demographic characteristics of the victim, location of victim's findings, social and psychiatric history, ligature's characteristic, signs of violence and toxicological analysis result.

All these aspects can lead forensic officers to a comprehensive suspicion of homicidal hanging. Forensic officers are not burdened to prove the manner of death, because that task is the investigator's authority. However, the results of forensic examination will be useful to conduct a thorough investigation, trying to find a possible perpetrator, and other supporting evidence. Homicide by hanging can be excluded when all other possibilities have also been eliminated.

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6. SUPPLEMENTS

Supplementary files 1 JBI critical appraisal result for case reports

Author (year)	Demographic characteristic	Patient history	Clinical condition	Diagnostic and result	Intervention	Post-intervention	Adverse event	Takeaway lesson	Conclusion
Lew (1988) [17]									
Vieira (1988) [18]		Yes							
Cooke (1988) [19]	Yes								
Abeyasighe (2009) [24]		No							
Ruwanpura (2010) [21]		Yes							
Sharma (2011) [16]	No	No	Yes	Yes	Yes	Not available	Not available	Yes	Valid
du Plessis (2012) [15]									
Sieswerda-Hoogendoorn (2014) [23]									
Behera (2015) [22]		Yes							
Monticelli (2015) [13]	Yes								
Zummerova (2015) [14]									
Geisenberger (2019) [20]									