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Strangulation Using Cable Ties and a Suicidal Manner of Death: A Case Report and Literature Review Addressing an Atypical Suicidal Mode

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Abstract: Background: Strangulation by ligature, most frequently employed for homicidal purposes, is not a common suicide method. Even more infrequent is the use by the victim of cable ties as a tool of self-strangulation. **Methods:** We describe a case of a 50-year-old woman who was found dead with a cable tie tight around her neck. In our case, analysis of the circumstantial data and the psychopathological history of the victim—along with an external examination, an autopsy, and toxicological findings—was crucial in the differential diagnosis between death intentionally inflicted by a third person and suicide. Through a narrative review conducted by performing a literature search using online resources (PubMed, Google Scholar, and ScienceDirect). **Results**: we were only able to identify eight similar cases. **Conclusions:** These were compared with our case, to trace similarities and differences, useful in guiding the forensic doctor in the diagnosis of death in such circumstances.

Keywords: forensic pathology; asphyxia; suicide; violent death; legal medicine

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1. Introduction

Strangulation is the obstruction of blood vessels and/or the airways by external pressure to the neck resulting in a reduced oxygen (O_2) supply to the brain [1].

In forensic medicine, three types of strangulation are recognized: hanging, ligature strangulation, and manual strangulation. The distinguishing factor among these types is the source of the constricting force on the neck. In hanging, the constricting force is the weight of the suspended body, which may be fully or partially supported by a ligature. In ligature strangulation, the constricting force is provided by a tight band encircling the neck, independent of body weight. Lastly, in manual strangulation, external pressure on the neck is applied by hands or other parts of the body [2,3].

Regarding the manner of death, hanging is more commonly associated with suicide, whereas manual strangulation is typically indicative of death intentionally inflicted by a third person.

Deaths intentionally inflicted by a third person resulting from ligature strangulation are frequent; however, this type of asphyxiation is rare in suicidal cases [4–6]. This is likely because self-strangulation demands a particularly strong and well-defined suicidal motivation. The victim must apply significant constrictive force to the neck to make the pressure lethal, while also overcoming the instinct to free themselves from the ligature until they lose consciousness.

In cases of ligature self-strangulation, the most commonly used tools include garments and accessories such as tights, belts, scarves, shirts, and shoelaces, as well as strings

and elastics [7–9]. Cases of ligature self-strangulation involving cable ties are only rarely reported in the literature [7]. This is notable because cable ties, which have a built-in tensioning mechanism, can serve as an alternative method to maintain pressure on the neck once the victim has lost consciousness.

When a victim is found dead from ligature strangulation, determining the manner of death—as death intentionally inflicted by a third person, suicide, or death intentionally inflicted by a third person disguised as suicide—can be challenging. In cases of ligature strangulation, no single forensic element definitively clarifies the manner of death. Each post mortem finding should be carefully analyzed, as it can provide valuable insights into the dynamics of the death [10].

First, a thorough analysis of the scene is necessary to identify elements that may suggest the manner of death, such as suicide notes, other potential means of suicide, and any indications of third parties present at the scene. Additionally, both the scene and the body should be examined for any drag marks or traces of blood. It is also crucial that the victim's medical history be reconstructed. It is known that most suicides worldwide are related to psychiatric diseases [11]. Even in cases of suicide by strangulation, victims often exhibit a psychiatric profile that is known to be at risk, and this is sometimes associated with advanced neurodegenerative diseases [6,7,12].

In cases of death by ligature strangulation, the external examination of the neck reveals ligature marks that vary depending on the tool used. Assessing the correlation between the ligature tool and the neck injuries is crucial, as is examining for periligature injuries. The presence of periligature injuries may suggest strangulation by a third party; however, this is not a definitive finding. Indeed, periligature injuries may be absent in cases where the victim has been rendered unconscious due to involuntary intoxication. Additionally, these injuries can also occur in suicidal cases if the victim, while still alive, attempts to free themselves from the ligature [13].

However, the external examination of the corpse must be thorough, searching for any defensive and/or offensive injuries that may indicate death intentionally inflicted by a third person. Before moving the body, it is important to collect nail samples (through extraction, clipping, and/or swabbing) to test for traces of foreign DNA [14]. Additionally, touch DNA analysis should be conducted on the ligature tool to detect and identify any DNA traces left behind [15].

Regardless of the manner of death, individuals who die from ligature strangulation often exhibit nonspecific post mortem signs of asphyxia, including facial congestion, skin and subconjunctival petechiae, possible hemorrhages from the nostrils and/or oral cavity, fluid and dark blood, pulmonary emphysema, and visceral congestion.

Toxicological tests are crucial in these death investigations. Collecting urine and/or blood samples is essential in determining whether the individual was using psychoactive substances or drugs while alive and/or whether the deceased can be considered to have been severely affected by drugs and possibly unable to perform the suicide, and hence whether a second party was involved. These forensic results, combined with an analysis of the circumstantial evidence, help clarify the manner of death in cases of strangulation.

Given the rarity of this cause of death—in terms of both the method and the tools used—we present a rare case of self-strangulation involving cable ties. This case is compared with other similar instances identified through a narrative review of the literature.

2. Case Report

2.1. Medical History of the Victim and Circumstantial Data

A 50-year-old woman was found with a cable tightly secured around her neck beside a cycle path by a river in Rome. No personal belongings were discovered near the body, and no suicide note was present at the scene.

An in-depth investigation was conducted, including interviews with the victim's family members and an analysis of her medical history, with assistance from her primary care physician. This comprehensive approach allowed for a reconstruction of the woman's family context and psychological profile.

First, the victim had a family history of depression and suicidal attempts. Based on the witness statements of the victim's brother, their mother had also attempted suicide that same morning with a similar cable. In fact, the man reported being woken up by his mother who could not free herself from the cable tie that she had wrapped around her neck in a suicide attempt. He cut off the constricting band and called for help. The mother was taken to the hospital, where her discharge summary indicated no other injuries. Additionally, she had been admitted twice in recent months for similar suicide attempts.

Afterward, noticing that his sister was not at home, he alerted the police.

The victim's mother corroborated the man's statement. Additionally, subsequent police investigations, including cell phone pings and testimonies from neighbours, confirmed that the man was not involved in his sister's death.

According to the victim's primary care physician, the deceased had suffered from long-term depression, characterized by multiple suicide attempts linked to socio-economic and personal factors, including financial problems and severe stress from bereavements. Medical records indicated that her primary care physician had been prescribing her with 40 mg per day of Paroxetine, an antidepressant in the selective serotonin reuptake inhibitor (SSRI) class, for approximately two years.

Furthermore, the analysis of circumstantial evidence revealed elements of premeditated suicide. Witness statements from the victim's brother indicated that the woman had purchased cable ties about three months prior to the incident and had planned to leave the house early the next morning to carry out her intentions. Her brother reported that threats and indications of premeditation regarding suicide were common in her daily life.

2.2. External Examination of the Corpse

The external examination of the corpse revealed facial congestion and well-defined cyanotic purple livor mortis, particularly pronounced on the neck and head (Figure 1). Facial congestion was evident, accompanied by multiple petechiae on the face, conjunctivae, and oral mucosa. Additionally, there was extensive bleeding in the conjunctiva of the right eye (Figure 2).



Figure 1. Discovery of the corpse during the death scene investigation. Close-up of the cable tie.

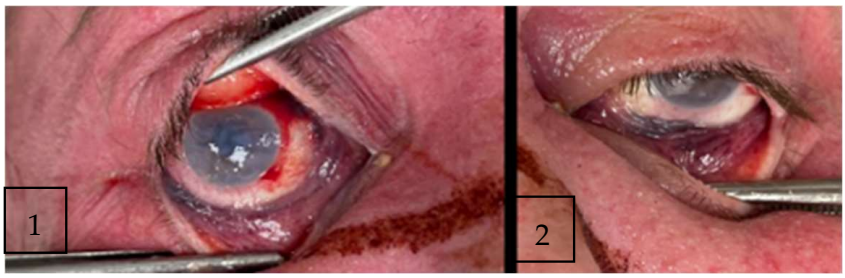


Figure 2. Subconjunctival hemorrhage in eyes (1, right eye; 2, left eye).

Bleeding was also noted from both nostrils. The ligature, a single cable tie, was found in situ, completely encircling the neck. A ribbon-like abrasion, consistent in shape and depth along the entire neck, corresponded to the cable tie.

The external examination of the body revealed no defensive or offensive injuries, and there were no periligature injuries.

2.3. Autopsy Findings

The day after the discovery, a complete autopsy was conducted. The dissection of the neck revealed minute haemorrhagic infiltrations in the deep muscles, specifically in the right belly of the omohyoid muscle and the sternohyoid muscle bilaterally, at the level of their proximal insertion (Figure 3). Additionally, there was further haemorrhagic infiltration on the anterior aspect of the thyroid cartilage medially. The osteo-cartilaginous structures of the neck were found to be completely intact.

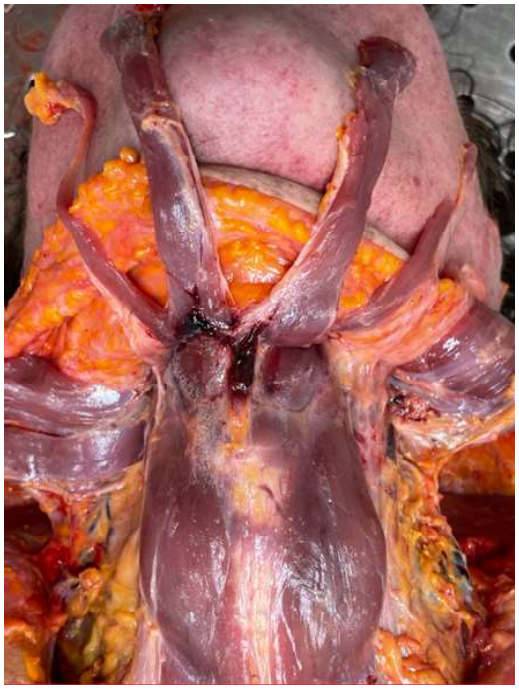


Figure 3. Close-up of the neck dissection.

Diffuse bleeding was also observed at the base of the tongue, the tonsils, the oropharynx, and the larynx (Figure 4).

The inspection, dissection, and compression of the lungs revealed subpleural haemorrhagic petechiae, severe congestion, and pulmonary emphysema (Figure 5).



Figure 4. Dissection en bloc of the tongue and pharynx.



Figure 5. Close-up of the lung section.

Finally, widespread visceral congestion was noted, with no other significant findings made during the autopsy. Histological examinations confirmed the macroscopic observations, showing erythrocyte infiltration in the muscles and soft tissues of the neck, indicating the vitality of the lesions. The microscopic examination of other organs and tissues revealed no notable findings, except for diffuse visceral congestion.

The liquid chromatography–mass spectrometry (LC–MS) analysis of urine was negative for metabolites of the primary substances of abuse, including MDMA, methadone, morphine, amphetamine, cocaine, THC, oxycodone, benzodiazepines, tricyclic antidepressants, ketamine, tramadol, buprenorphine, and selective serotonin reuptake inhibitors (SSRIs). The negative results from the antidepressant drug screen indicated that the woman had not adhered to the prescribed therapy in the days leading up to her death.

Gas chromatography showed no presence of ethyl alcohol in the blood. Lastly, no foreign DNA was detected beneath the victim's fingernails or on the cable tie.

2.4. Cause and Manner of Death

The external examination revealed no injuries other than those to the neck region, and there were no defensive injuries or signs of a struggle. Furthermore, no dragging marks from the corpse were present at the scene. The neck injuries were entirely consistent with

the use of a cable tie, and there were no nail marks on the neck that might indicate ligature by a third party.

Bloodstain pattern analysis of the bleeding from both nostrils, attributed to the occlusion of the jugular vein and carotid artery, indicated that the blood flowed in the direction of gravity. This suggests that blood flowed from both nostrils in accordance with gravity, consistent with the supine position of the body at the time of discovery. This finding reinforces the hypothesis that the victim died in the same position in which she was found [16].

The autopsy confirmed the absence of any signs of assault by third parties. The internal examination revealed findings consistent with the direct action of the ligature and the mechanism of asphyxiation, including diffuse petechiae, pulmonary emphysema, and visceral congestion.

Additionally, the dissection of the neck showed no widespread hemorrhagic infiltration of soft tissues or laryngeal fractures, which are more commonly observed in cases of homicidal ligature strangulation [13].

Finally, toxicological testing ruled out intoxication, indicating that the victim was fully conscious at the time of death. The absence of periligature marks, combined with the negative toxicological screening, supports the hypothesis of a suicidal act.

These forensic findings, along with the circumstantial evidence and the victim's medical history, led to the conclusion that the death was due to violent mechanical asphyxia resulting from suicidal strangulation with a ligature.

Differential Diagnosis Between Suicidal and Homicidal Manner

There were some suspicious elements in this case that may point toward death intentionally inflicted by a third person:

- two cases of attempted suicide in the same way (mother and daughter);
- the absence of DNA evidence or other injuries could be explained by, for example, the use of gloves by a potential killer;
- the isolated location where the victim was found.

These elements can be explained by the following points:

- Psychiatric disorders can have a family component, and suicidal behaviour might be familiarly transmitted [17].
- The mother also confirmed that she had attempted suicide in the same way and that her daughter, before committing suicide, had repeatedly expressed suicidal ideation.
- The absence of DNA evidence alone is not decisive in identifying a suicide. However, the absence of any other injuries, while not specific, is extremely suggestive of suicide in this case. This statement is supported by the complete negativity of the toxicology tests, which suggest that the victim was conscious at the time of the event. Therefore, it is unlikely that a conscious individual would not attempt to free themselves from the cable tie in some way. In the case of a sleeping individual, it is highly improbable that the application of a cable tie would not cause them to wake up. If the individual were immobilized, it is unlikely that no injury would be found to the limbs.
- The public place where the body was found (beside a cycle path by a river) may seem unusual for a suicide. Instead, as shown in the literature, public places are often chosen by suicide victims [18]. Furthermore, the investigations did not identify any elements that might suggest that the woman was not alone. Finally, there were no signs indicating that the body had been moved.

In conclusion, although the atypicality of the manner of death initially suggested the possibility of death intentionally inflicted by a third person, it is essential that we consider all of the available evidence (both circumstantial and autopsy-related). Indeed, the absence of DNA evidence, the negative toxicological findings, the lack of any physical injuries,

the subject's long history of psychopathology, repeated suicidal ideation, the testimonies collected, and the investigative elements all allow for the exclusion of death intentionally inflicted by a third person as a plausible hypothesis.

3. Narrative Review

3.1. Methods

A narrative review of the literature was performed to find cases of self-strangulation with cable ties. This was to compare our case with other similar ones and to identify the forensic findings of suicidal mode in this type of death.

In January 2024, two authors carried out independent research using online resources (PubMed, Google Scholar, and ScienceDirect) by entering the following keywords: "self-strangulation AND cable AND ties", "self AND strangulation AND cable AND ties", "ligature AND strangulation AND strangulation AND cable ties AND suicide", "strangulation AND ligature AND suicide AND zip AND ties", and "ligature AND strangulation AND suicide".

A third author excluded duplicates and articles that could not be fully accessed.

After a thorough read of the remaining studies, articles not related to our study, as well as those in which there was no diagnosis of suicidal death, were excluded, reaching the final number of six articles [8,19–23] and a total of eight cases.

3.2. Results

Eight cases of suicidal ligature strangulation with cable ties are reported in the literature. Only one case was a woman [8]. Only in two cases were the circumstantial data irrelevant [8,20]. In four cases, a suicide note from the victim was found at the scene of death [8,19,21,22]. The results of the literature review are extensively reported in the Supplementary Materials and summarized in Table 1.

Table 1. Findings from eight cases of suicidal ligature strangulation using cable ties.

	Sex	Age	Ligature Tool(s)	Psychiatric History	Anti-Conservative Behaviours	Suicide Note	Haemorrhagic Petechiae	Haemorrhagic Infiltration of Neck Soft Tissues	Fractures in the Neck Structures	Toxicology Report
[8] Case 1	M	37	Two cable ties and a belt	Positive	No	Absent	Conjunctival	Absent	Absent	Positive
[8] Case 2	F	63	Multiple cable ties	Positive	No	Absent	Conjunctival, facial, and on the neck	Multiple, small, focal	Absent	Positive
[8] Case 3	M	54	Two cable ties	Positive	Yes	Present	Absent **	Absent **	Absent	Positive
[19]	M	50	One cable tie	Negative *	No *	Present	Conjunctival	Contusion of the neck muscles	Absent	Positive
[20]	M	75	One cable tie	Positive	Yes	Absent	Facial	Small amount of bleeding	Absent	Positive
[21]	M	48	Multiple cable ties	Negative *	No *	Present	Conjunctival	Right thyrohyoid muscle	Absent	Negative
[22]	M	40	Two cable ties	Positive	No	Present	Conjunctival and palpebral	Absent	Absent	Unspecified
[23]	M	25	Two cable ties	Negative *	No *	Absent	Conjunctival and on the mouth mucosa	Contusion of the neck muscles	Absent	Positive

* Negative or unknown/unspecified; ** the body was found at the stage of putrefactive changes.

4. Discussion

Our review highlighted the rarity of self-strangulation using cable ties and allowed us to compare our case with those documented in the literature. As noted, in cases of ligature strangulation, the mechanism of death is asphyxial. In such situations, determining the manner of death can be complex. Therefore, conducting a thorough death scene

investigation is essential in order to gather circumstantial evidence, such as the presence of drugs, suicide notes, or other means of self-harm.

Additionally, examining the scene of death is crucial in excluding signs of struggle or the involvement of third parties at the time of death. It is equally important to reconstruct the deceased's psychiatric history to identify potential risk factors for suicide.

In our case, the investigation of the death scene revealed no significant evidence. No suicide notes, drugs, or other means of self-harm were found near the corpse. However, it was observed that only the area of vegetation beneath the body was flattened, indicating that the body had not been dragged to the site of discovery.

In contrast, in four cases documented in the literature, a suicide note was found at the scene [8,19,21,22]. As is well known in forensic psychiatry, the discovery of a suicide note at the scene provides a valuable contribution to investigations, offering crucial insights into the reasons behind the act [24]. Few studies in the literature investigate the differences between suicide victims who leave notes and those who do not. In general, the "note leavers" tend to attribute their actions to socio-relational, financial, or health-related issues. Furthermore, they are often not known to have a history of psychiatric disorders or previous hospitalizations [25,26]. Although still incomplete, these data appear to align with our case. Specifically, the victim—who did not leave a suicide note—had a long history of depression, had previously attempted suicide, and had frequently expressed suicidal intentions.

Additionally, in two of these cases, drugs, alcohol, and/or chemical substances were found near the body [8,23]. In these cases, post mortem toxicological examination suggested the ingestion of these substances. In our case, the toxicology test was negative, and no other suicidal means were found at the scene besides the cable ties. This was possibly because the woman was aware of the lethality of the tool that she had chosen weeks earlier.

Although the scene of death in our case presented no evidence, we conducted a thorough review of the victim's health documentation. We found that she had been suffering from depression for several years and had previously attempted suicide.

This aligns with the findings of our literature review. In fact, in five out of eight cases, the victims had a history of psychiatric disorders and/or alcohol abuse, as well as previous suicidal behaviour and/or suicidal ideation [8,20,22]. This result is particularly relevant, given that clinical and forensic studies have shown a variable correlation between previous suicide attempts, psychiatric history, and death by suicide [27–29]. Furthermore, this finding underscores the critical importance of collecting and thoroughly examining the victim's psychiatric history (psychological autopsy) in understanding the cause and manner of death in atypical suicides [22,23,30–32]. This type of forensic investigation is vital not only in determining the manner of death but also in suicide prevention, as the incidence remains alarmingly high [24].

In our case, the ligature tool used was a single cable tie. Notably, only two cases documented in the literature also involved a victim using a single cable tie. [19,20]. However, in both of those cases, the victim had also consumed substances prior to the act (organophosphorus [19], alcohol, and mirtazapine [20]). Therefore, to the best of our knowledge, ours is the only case documented in the literature involving ligature self-strangulation with a single cable tie accompanied by negative toxicological tests for psychoactive substances or alcohol.

More commonly, victims have used multiple cable ties, resulting in more than one ligature mark [8,23], or linked multiple cable ties to form a single ligature around the neck [21,22]. In one instance, cable ties were used in combination with a belt as a second ligature tool [8]. Additionally, in one case, other ligature means, although not used in the fatal act, were found near the corpse [23].

The use of multiple cable ties and/or other ligature tools may be due to the possibility that the victim sometimes fails to complete the act or does not lose consciousness with a single cable tie.

Additionally, suicides involving cable ties are often preceded by the intake of toxic chemicals, high-dose medications, or alcohol. In two cases, organo-phosphorus compounds [19] and brodifacoum [23] (a pesticide used for rodent control) were found in the victims' stomachs. Toxicological examinations in three cases revealed the presence of ethanol in the blood [23]. Furthermore, in two instances, toxicological tests were positive for antidepressant medications (fluoxetine, bupropion, and mirtazapine), and in one case, they were positive for an antihistamine (diphenhydramine) [8,20]. Therefore, our review indicates that cable ties are frequently used as a suicide method, often in conjunction with other mechanical and/or chemical means. This finding further demonstrates the strong determination of victims who choose this method of death.

Our review revealed results similar to our findings regarding external examinations. The most common external signs were consistent with mechanical force being applied to the neck. Specifically, all cases (except one with putrefactive changes [8]) exhibited ligature marks on the neck, along with signs of the mechanical compression of the neck vessels. These included congestion above the ligature, compression marks on the neck, and skin petechiae (on both the neck and face), as well as subconjunctival and/or oral mucosa petechiae and bleeding from the nose and/or mouth.

These forensic findings, although variable depending on the ligature tool, are characteristic of ligature self-strangulation and were also observed in our case [19,20,33].

In instances of suspected self-strangulation where bleeding from the mouth or nostrils is present, bloodstain pattern analysis can help determine whether the corpse was moved by a third party [34]. If that were the case, the blood would not flow in the direction of gravity. In our case, blood flowed from both nostrils in a manner consistent with the body's position at the time of discovery, suggesting that the woman died in the position in which she was found.

Furthermore, in none of the described cases—including ours—were traumatic or defensive injuries found. In all cases, the dissection of the neck revealed only minimal bleeding in the neck muscles. Similarly, our autopsy showed only minute haemorrhagic infiltrations in the deep muscles of the neck. Notably, there were no fractures in the osteo-cartilaginous structures of the neck in any of the cases, including ours.

This result is characteristic of ligature self-strangulation. In contrast, in cases of homicidal ligature strangulation, laryngeal fractures are more common, and bleeding in the soft tissues of the neck is typically more pronounced, likely due to the greater force exerted by the aggressor on the victim's neck [13].

While this is a frequent finding in self-strangulation cases involving other ligature tools, it is particularly typical in cases of self-strangulation with cable ties. By their nature, cable ties exert a localized constrictive force on the neck, leading to focal haemorrhagic infiltrations in the soft tissues. Additionally, when used alone, cable ties do not apply sufficient mechanical force to cause fractures in bony or cartilaginous structures. This observation is often applicable to other types of self-strangulation using thicker tools and/or combined methods [35].

Regarding other autopsy findings, violent mechanical asphyxiations—regardless of the subtype, medium used, or manner of death—are typically associated with nonspecific signs, such as dark-red blood in the heart, subpleural and epicardial hemorrhagic petechiae, pulmonary edema and emphysema, or visceral congestion [36]. In our case, similar signs of asphyxia were observed, including subpleural hemorrhagic petechiae, severe congestion,

pulmonary emphysema, and widespread visceral congestion. Moreover, our literature review did not yield significant autopsy findings in this area.

5. Conclusions

Suicide by ligature strangulation is rare. Our review identified only eight cases of ligature self-strangulation using cable ties documented in the literature.

When encountering a subject found dead with a cable tie around the neck, it is essential that the forensic investigator meticulously gathers all circumstantial data and thoroughly assesses the victim's psychiatric history. As our review indicates, this atypical form of suicide often occurs in individuals with a history of psychopathology.

Furthermore, given the frequency of the use of combined tools highlighted in our review, it is crucial that a comprehensive examination of the crime scene be conducted to check for other means of suicide. Additionally, toxicological tests of gastric contents, blood, and urine should be performed to determine whether the victim had ingested drugs and/or alcohol prior to death. These findings, combined with a thorough external examination of the corpse—which should show no signs of third-party injuries—are vital in accurately determining the cause and manner of death.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/forensicsci5010001/s1, Table S1: Results of literature review of cases of ligature self-strangulations using cable ties.

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