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### ORIGINAL ARTICLE

## Epidemiological characterization and findings in homicides due to suffocation with plastic bags in the city of Medellín, Colombia 2008-2021

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#### Abstract

**Introduction:** This study describes the characteristics of the victims of deaths by homicidal suffocation with plastic bags in the period between 2008 and 2021, in autopsies performed at the National Institute of Legal Medicine and Forensic Sciences of the city of Medellín.

**Materials and methods:** A descriptive, retrospective study was carried out, whose information was obtained from the autopsy reports made by forensic doctors of the institution.

**Results:** Of the 38 772 autopsies performed, 17 703 were homicides, of which 96 (0.54%) were due to the use of plastic bags to produce death. Of the 96 cases analyzed, 92.7% (89) corresponded to men and 7.3% (7) to women. The young male population between the ages of 15 and 27 was the most affected; 74.4% (71) entered as unidentified corpses and in 17.1% (14) the diagnosis of torture was considered within the analysis of the legal medical necropsy.

The findings of suffocation in the external examination were facial congestion 67.1% (55), petechiae in the conjunctivae 63.4% (52), petechiae on the face 28.0% (23), lesions in the internal oral mucosa 61.0% (50), and abrasions in the labial commissures 25.6% (21) due to the use of foreign elements in the oral cavity or the application of maneuvers to cause asphyxia. 58.5% (56) presented signs of trauma in other parts of the body that did not explain the cause of death. 36.4% (35) had plastic bags covering the head and adjusted to the neck with some element, 32.3% (31) transparent tape attached to the plastic bag that covered the head, and 31.3% (30) presented a plastic film with the trade name Vinipel MR. 76.8% (73) had their hands and feet tied when the body was found at the scene.

**Conclusion:** This is the first step to obtain information on the characterization of individuals and their macroscopic findings related to homicide deaths due to suffocation with plastic bags, to warn about the actions of organized criminal groups and their practices in the transnational

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context. However, its analysis requires an adequate exploration of the scene, the results of the investigations carried out by the authority and the performance of an exhaustive necropsy to achieve a diagnosis.

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## PALABRAS CLAVE

Asfixia;  
Sofocación;  
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Homicidios;  
Manera de muerte;  
Autopsia

## Caracterización epidemiológica y hallazgos en homicidios por sofocación con bolsas de plástico en la ciudad de Medellín, Colombia 2008-2021

### Resumen

**Introducción:** El presente estudio describe las características de las víctimas de muertes por sofocación homicida con bolsas de plástico en el período comprendido entre 2008 y 2021, en necropsias practicadas en el Instituto Nacional de Medicina Legal y Ciencias Forenses de la ciudad de Medellín.

**Materiales y métodos:** Se realizó un estudio descriptivo, retrospectivo, cuya información se obtuvo a partir de los informes de necropsia realizados por médicos forenses de la institución.

**Resultados:** De las 38.772 necropsias realizadas, 17.703 fueron homicidios de las cuales 96 (0,54%) fueron debidas a la utilización de bolsas de plástico para producir la muerte. De los 96 casos analizados el 92,7% (89) correspondieron a hombres y el 7,3% (7) a mujeres. La población masculina joven de los 15 a 27 años fue la más afectada; el 74,4% (71) ingresaron como cadáveres no identificados y en el 17,1% (14) fue considerado el diagnóstico de tortura dentro del análisis de la necropsia médico legal.

Los hallazgos de sofocación en el examen externo fueron congestión facial 67,1% (55), petequias en las conjuntivas 63,4% (52), petequias en la cara 28,0% (23), lesiones en la mucosa oral interna 61,0% (50) y excoriaciones en las comisuras labiales 25,6% (21) por el uso de elementos extraños en la cavidad oral o la aplicación de maniobras asfícticas. El 58,5% (56) presentaban signos de trauma en otros sitios del cuerpo que no explicaban en sí la causa de la muerte. El 36,4% (35) presentaban bolsas de plástico cubriendo la cabeza y ajustadas al cuello con algún elemento, el 32,3% (31) cinta transparente adherida a la bolsa plástica que cubría la cabeza y el 31,3% (30) presentaban una película plástica de nombre comercial Vinipel MR. El 76,8% (73) tenían las manos y los pies atados al momento del hallazgo del cuerpo en la escena.

**Conclusión:** Este es el primer paso para obtener información de la caracterización de individuos y sus hallazgos macroscópicos relacionados con las muertes homicidas por sofocación con bolsas de plástico, alertar sobre actuación de grupos delincuenciales organizados y las prácticas de estos en el contexto transnacional. Sin embargo, su análisis requiere una adecuada exploración de la escena, los resultados que arrojen las investigaciones adelantadas por la autoridad y la realización de una necropsia exhaustiva para lograr su diagnóstico.

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## Introduction

Suffocation is a broad concept that includes obstruction of the epiglottis, the nose, the mouth, and the pharynx (smothering and choking), impeding the capture and use of oxygen due to displacement by other gasses, generally under conditions of confinement. More specifically, suffocation by a plastic bag involves inability to capture or consume oxygen and eliminate carbon dioxide.<sup>1</sup>

Death by suffocation with a plastic bag is associated with the scarcity or absence of the classic signs of asphyxia, such as facial and cervical congestion, subconjunctival petechiae, foam in the nasal fossae and the oral cavity. In the internal examination, acute edema of the lungs is also rare, as are foam in the airways, pulmonary hemorrhage and congestion, subpleural and epicardial petechiae, and visceral

congestion. This is why its diagnosis is based on the analysis of the scene and the presence of the plastic bag or similar object covering the victim's head.<sup>2,3</sup>

Cases of death with a plastic bag covering the head have been widely documented and discussed in suicides; nevertheless, there are few cases in association with homicides.<sup>3-8</sup> An exhaustive search in PubMed, Science Direct, Google Scholar, Scopus, and Embase for the key words "plastic bag suffocation, homicide, manner of death, asphyxia, autopsy" found 23 papers and 2 books, few of which were directly about the subject of this study.

The majority of the cases described in the literature of death due to suffocation with a plastic bag refer to suicides or accidents. Of the 468 deaths found in different publications, 96% were suicides, 3% were homicides, and 1% were accidental deaths.<sup>9</sup> The rise in the use of plastic bags as a

suicide technique occurred after the publication of the book “Final exit: The practicalities of self-deliverance and assisted suicide for the dying”. Individuals with a history of psychiatric problems or terminal illnesses used this method with the help of medication that depressed the central nervous system (CNS).<sup>5</sup>

Few studies cover the causes of homicides; Polson states that until 1984 no homicides had been committed using plastic bags.<sup>7</sup> Knight mentions 3 cases,<sup>3</sup> while Bayard et al. describe 2 cases.<sup>6</sup> Boghossian et al. describe 2 homicides in similar circumstances<sup>7</sup> and Crudele et al. mention on death by homicide using the said instrument.<sup>8</sup>

The above-mentioned studies show how little research has been undertaken into homicides by suffocation with a plastic bag. This underlines how little information there is on associated macroscopic findings. Deaths caused by these instruments in the cases of suicides are associated with the use of medication to depress the CNS, with a slow death in repose. Homicides involve a painful death and the CNS activation of catecholamine-mediated mechanisms. Furthermore, this shows the need to describe the general characteristics of the individuals who are exposed to this situation, unlike the available literature in this field because of the physiopathological changes which are triggered in the victims.

This study aimed to describe the main epidemiological characteristics and clinical signs of homicides using a plastic bag, in the medical–legal autopsies carried out in Medellín *Instituto Nacional de Medicina Legal y Ciencias Forenses* from 2008 to 2021. This research is important because of the lack of publications worldwide in the literature and the need to outline explanations for this phenomenon.

## Materials and methods

*Type of study:* Descriptive, of a retrospective cohort.

*Study population:* Of the total of 38 772 necropsies carried out in the period 2008–2021 in Medellín *Instituto Nacional de Medicina Legal y Ciencias Forenses*, 115 cases of death by suffocation with a plastic bag were found. All of the necropsy reports and photographs were reviewed.

The selection criteria were cases where individuals had been found with a plastic bag over their head, when the autopsy was undertaken from 24 to 36 h post-mortem, and without other injuries that could explain the death. Of the initial cases considered, 19 necropsies were excluded as they did not clearly report how the diagnosis of suffocation was reached and did not mention these elements as leading to death. That is, they did not offer clear descriptions or the findings that led to the diagnosis, or did not include the complete exploration of the face and neck or did not completely identify the signs of asphyxia or omitted them, or they referred to cadavers in a state of decomposition. A total of 96 cases were included, whose manner of death was homicide, and which fulfilled the selection criteria described above.

*Data gathering:* The information source was secondary to the Identification System Register of Disappeared Individuals and Cadavers (SIRDEC), the database platform of the *Instituto Nacional de Medicina Legal y Ciencias Forenses*, with head offices in Medellín, which receives the

information generated by the medical–legal necropsies undertaken. Forensic experts send all of the information to this platform covering variables such as the identification of victims of violent crime, the manner and cause of death, summaries of the reports on the examination of cadavers, and necropsy findings. The institute performs a quality control check on the said expert reports by means of peer review before approving them for subsequent printing and delivery to the judicial authorities.

*Bias control:* Selection bias was controlled by including all of the subjects who fulfilled the selection criteria. Information bias was controlled by legal medicine professionals using strategies such as necropsy auditing, by reviewing 100% of the reports. Data extraction bias from the secondary source was controlled by double digitation and logical verification.

*Analytical plan:* Age (the sole continuous variable) was described using the average, standard deviation, inter-quartile range, and range; the other variables were categorical, and these are described using absolute frequencies (*n*) and relative frequencies (%). The database and analyses used SPSS 27.0 statistical software.

*Ethical aspects:* The principles of the Helsinki Declaration were applied, together with Resolution 8430 of 1993 of the Ministry of Health of Colombia. Legal medicine guidelines were followed to guarantee that information was only used research purposes, and analyses were based on data that contained no information which could lead to the identification of individual cases, given that a legal medicine professional delivered a blinded file (without any case identification data).

## Results

The average age of the population studied was 32.5 ± 15.9 years. 50% of the data were central, from 15 to 27.5 years, and a range from 27.5 to 99 years (Table 1).

The outstanding findings in terms of sociodemographic characteristics were that the majority were men, single, with secondary education, while 37.4% (*n* = 36) had a criminal record, all of whom were men (Table 2).

74.4% of the subjects studied were admitted as an unidentified cadaver (UC), and the main locations where the body was found were the public highway, inside a public service vehicle (taxi) and in a dwelling (Table 3).

The georeferenced locations where the bodies were found were distributed in places that were distant from

**Table 1** Age and sex of the victims.

Sex	Age group (years)	<i>n</i>	%
Men	15–25	39	40.6
	26–35	30	31.3
	36–45	10	10.4
	46–55	5	5.2
	56–65	4	4.2
	>65	1	1
Women	15–25	2	2.1
	26–35	3	3.1
	>65	2	2.1

**Table 2** Sociodemographic characteristics of the study population.

Variable	Category	n	%
Sex	Male	89	92.7
	Female	7	7.3
Marital status	Married—Living together	30	31.3
	Single	52	54.2
	Widowed	1	1
	Separated	1	1
	No data	12	12.5
Educational level	Primary	29	30.2
	Secondary	42	43.8
	Higher	6	6.2
	No data	19	19.8

city centers and with few people from them or the suburbs, historically stigmatized by the violence from 1980 to 1990.

The years with the highest numbers of cases were 2013 with 16 cases (16.7%), and 2009 and 2011 with 14 cases each (14.6%); with the lockdown due to the pandemic in 2020, there were 2 cases. The months with the highest numbers of cases were April, May, and August, with 10 cases each, and July and September with 9 cases. In terms of the time the bodies were found, the highest number of cases occurred from 23:00 h to 01:00 h (46.1%).

4.1% of the victims had a pre-existing disease (those over the age of 60 years), the most frequent cause of which was the presence of advanced coronary disease described macroscopically after the dissection of the coronary arteries.

According to the expert medical–legal necropsy reports, some of the interventions suggested by the Minnesota Protocol were applied to 35 cadavers (36.5%) (complete radiographies prior to opening the body, or special incisions to search for hidden trauma, for example).<sup>14</sup> 14.6% of the necropsy reports that were reviewed mention torture, while this was not considered in the other 82 cases (85.4%).

The most representative signs of asphyxia among the findings in the bodies that were examined were: a congested face, 63 cases (65.6%); conjunctive petechiae in 52 cases (54.2%); lesions in the oral mucosa in 50 cases (52.1%); a weight of both lungs greater than 1000 g in 49 cases (51%); petechiae in the serosae of the visceral pleura and the epicardium in 40 cases (41.7%); petechiae on the face in 23 cases (24%); excoriations in the commissures of the lips in 21 cases (21.9%); and a bitten tongue in 19 cases (19.8%) (Table 4).

**Table 3** Location where the body was found.

Scene	n	%
Public highway	42	43.8
Dwelling	11	11.5
Public transport vehicle (taxi)	13	13.5
Private vehicle	10	10.4
River, stream, wetland	8	8.3
No data	12	12.5

**Table 4** External and internal macroscopic findings.

Sign	n	%
Congested face	63	65.6
Petechiae on the face	23	24.0
Conjunctive petechiae	52	54.2
Edema of the eyelids	18	18.8
Chemosis	9	9.4
Excoriations in the commissures of the lips	21	21.9
Internal ecchymosis in the oral mucosa	50	52.1
Bitten tongue	19	19.8
Congestion of the petrous part of the temporal bone and lamina cribrosa	12	12.5
Petechiae in the epicranial aponeurosis	6	6.2
Petechiae in the serosa of the lung -heart	40	41.7
Weight of both lungs more than 1000 g	49	51.0

On average, each individual had  $5.7 \pm 2.0$  of the above-mentioned signs, with a range from 1 to 10, while 50% of the individuals had 6 signs or fewer, with 50% of central values between 4 and 7.

Respecting the other injuries that were described in the external examination of the victims, 80 individuals (83.3%) also had signs of injuries caused by a blunt instrument that did not explain the death, on the face, neck, thorax, and the upper and lower limbs.

76.8% (73) of the individuals had their hands and feet tied at the time the body was found at the scene.

## Discussion

38 772 medical–legal necropsies were performed during the period studied in the Nacional Institute of Legal Medicine and Forensic Science with head offices in the city of Medellín. Of these, 681 (1.8%) corresponded to homicides by mechanical asphyxia, and of these, only 96 (14.1%) were linked to suffocation using a plastic bag; this underlines the divergence with the small amount of information reported in the literature in English.<sup>3,7</sup> The number of cases in the previous studies is far lower than those in this study, as on the one hand, they only cite 8 cases in general, 3 cases without specifying either age or sex,<sup>3</sup> 2 children under the age of 11 years without specifying their sex,<sup>8</sup> 2 cases of a 4-year-old girl, and a man aged 79 years,<sup>5</sup> and 1 case of an 83-year-old woman.<sup>7</sup> On the other hand, because no sociodemographic characteristics or any aspects associated with the conditions under which the victims were found are described. Moreover, few signs of asphyxia found in the bodies are described.

The highest proportion of deaths due to suffocation with a plastic bag corresponds to men who were single, with a low educational and economic level; this sociodemographic profile shows that the characteristics of the individuals in this study fit with the panorama described in previous studies in the city, as they underline a public health problem in the context of poor socioeconomic conditions, with great social inequality, in which men are the main actors in this and other types of violence.

In many cases, the finding of a large number of bodies in the public highway or inside public transport vehicles around

midnight or in the early morning shows that a warning message is being sent by their enemies. This corresponds above all to sectors of the population which have been stigmatized by the violence generated by drug traffickers and the lack of control by the authorities in many sectors of the city, thereby contributing to a deepening of the phenomenon of violence.<sup>11</sup>

The significant number of deaths caused by this mechanism in the years 2009, 2011, and 2013 can be explained by the reforming of criminal structures after the extradition to the United States of several leaders of criminal organizations, or in other cases by the deaths of such leaders due to action by the state authorities.<sup>12</sup> Nevertheless, this method of causing death (suffocation with a plastic bag) may be associated with the criminal actions of a certain illegal group or faction of the same as a sign of the identity of the organization, similar to the cases of *incaprettamento* (postural asphyxia) described in the literature as being used by the Italian mafia.<sup>13</sup>

Several signs of asphyxia which are reported as subtle or even non-existent in the medical literature in this field were found.<sup>3–5</sup> This is because the great majority of these studies cover suicides.<sup>5,14–16</sup> The study of suicides using this method by Crudele et al. in 2015 is a useful source of comparison with the findings of the internal and external examinations in this study. Of the 101 cases analyzed in the city of Milan during the period from 1993 to 2013, 100 cases corresponded to suicides, and only 1 to a homicide. The findings of the external examination were: facial congestion in 12 cases and 7 cases of cervical congestion, 14 cases with the presence of conjunctival petechiae, 14 of abrasions on the face, and 7 on the neck, bloody secretion through the respiratory orifices in 13 cases and 6 cases of ecchymosis on the face and 4 on the neck, and marks of bonds on the neck in 9 cases. Internal examination found the presence of ecchymosis in the lung serosa or in the epicardium in 83 and 14 cases, respectively. Foaming fluid was found in the airways in 15 cases, with pulmonary edema and congestion in 86 cases, blood fluidity in 80 cases, and generalized visceral congestion in all cases.<sup>8</sup>

In this study, facial congestion was found in 8 cases, while areas of facial congestion were found in 63 cases (explained by the pressure exerted on the face and the concomitant use of tapes around the bags, and the use of Vinipel-type plastic film). Conjunctival petechiae were observed in 52 cases, with petechiae on the face in 23 cases, as well as palpebral edema and chemosis in 18 and 9 cases, respectively. Excoriations were observed on the commissures of the lips in 21 cases, and unspecified lesions were found in the oral cavity in 50 cases, with a bitten tongue in 19 cases. Internal examination found petechiae on the pulmonary and cardiac serosae in 40 cases and pulmonary edema in 49 cases, while all cases had facial and visceral congestion.

Petechiae were found in the pulmonary and cardiac serosae in many more cases than in this work, as was pulmonary congestion. Conjunctival petechiae were found in the present study far more often, as were lesions restricted to the oral cavity. This is associated with the fact that these findings are accentuated when there has been some degree of struggle, as this triggers the production of catecholamines.<sup>17</sup>

Comparison of the findings in the work by Crudele and this study shows that the victims analyzed by the former show a combination of suffocation with a plastic bag and the concomitant use of medicaments, hydrocarbons, volatile substances, and alcohol, and that 87 victims had underlying illnesses.<sup>8</sup> In our study, the victims were young individuals, a considerable number of whom were in good health. They were made defenseless by tying their wrists and ankles, and they also received multiple injuries in other parts of the body, although these were not a cause of death. On the other hand, there was no significant number of cases of consumption of alcohol or drugs such as cocaine. This finding makes it possible to hypothesize that the varied presence of signs in this study is linked to a state of intense suffering prior to death.<sup>18</sup> It is even possible to infer that the use of a plastic bag was part of a previous process of torture before being used as a homicidal tool to cause death.

This method has not been used often in suicides in Colombia, and it is rarely described or said to have been used in local forensic literature. Nor are there references to its use in homicides. These cases are now important as it is necessary to establish a diagnosis within the violent panorama of our environment.

The limitations of this study arise in connection with the lack of concurrent studies in histopathology, biochemistry, and immunohistopathology. Nevertheless, the results obtained to date were controversial and hardly conclusive for use in cases of suffocation with a plastic bag.<sup>17</sup> Furthermore, not all of the files reviewed of the cases that were analyzed contained toxicological reports to explain possible states of defencelessness, and histopathological studies were not performed on all of the bodies.

## Conclusion

This study is the first step in obtaining information on the characterization of individuals and the macroscopic findings associated with homicides by suffocation with a plastic bag, to make the current body of knowledge in this field more robust. This is especially so with reference to the texts of legal medicine and other publications in connection with the crime of homicide using these elements as the mechanism to cause death.

On the other hand, it makes it possible to create warnings about this *modus operandi* and the transfer of these practices to transnational crime. In our case, it has enabled the consolidation of criminal gangs which use extreme methods in their operations and changing ways of murdering their opponents, as well as being used as a means of torture.

Lastly, deaths by suffocation with a plastic bag require analysis at the scene, together with investigations forwarded by the authority and an exhaustive necropsy for diagnosis.

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## Declaration of competing interest

The authors have no conflict of interests to declare.



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