

# Performance of the previous examination in the necropsy room with the scott test (ammonium thiocyanate and cobalt chloride – in acid medium), to identify cocaine, valid conduct or waste of time

## Abstract

This article is the result of examinations carried out on corpses, which were admitted to one of the Technical-Scientific Police services of the Civil Police of the State of Rio de Janeiro, whose deaths were suspected of being due to exogenous intoxication due to the use of a prohibited substance. (cocaine); aims to present a proposal for research on cocaine, in corpses suspected of death due to exogenous intoxication, carrying out an analysis of the material found in the nasal cavities, when the necropsy examination begins, providing a bias for the Coroner, regarding the visceral findings identified, as well as presenting proposals regarding requests for subsidiary toxicology research exams.

**Keywords:** cocaine, toxicological examination, pcerj, proposal

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## Introduction

Carrying out a prior examination, by teams from the General Technical-Scientific Police Department of the Civil Police of the State of Rio de Janeiro (PCERJ-SEPOL), when a substance that resembles cocaine is seized by police institutions, whether military or civil, allows the drawing up of the arrest report in flagrante delicto. In cases of suspected death due to exogenous poisoning, as well as in cases of seizure of a suspected substance, blood and fragments of viscera are sent to the toxicology sector to identify the substance used. This work aims to present a routine that can be used in cases of death due to exogenous intoxication suspected of cocaine use. With the aim of facilitating the necropsy examination, giving the Coroner a bias to understand the possible findings, as well as directing requests for subsidiary toxicology research examinations, we began the procedure, with the examination carried out, through the Modified Scott (ammonium thiocyanate and cobalt chloride – in an acidic medium), in those cadavers that presented the presence of a substance similar to cocaine in the nasal and oral cavities.

## History

The Scott test is an experiment that was developed by L. J. Scott Jr., in 1973. Its objective was to detect cocaine through a chemical reaction involving the compound called “cobalt thiocyanate”. This test was based on the cobalt thiocyanate test and is carried out in stages, requiring a positive reaction in all three stages for the correct identification of the drug.<sup>1</sup> The test uses 2% cobalt thiocyanate reagent

<sup>1</sup>Mcgill JW, Dixon CA, Ritter D. Discovery of an interesting temperature effect on the sensitivity of the cobalt thiocyanate test for cocaine. *Microgram Journal*. 2008;6:26–35.

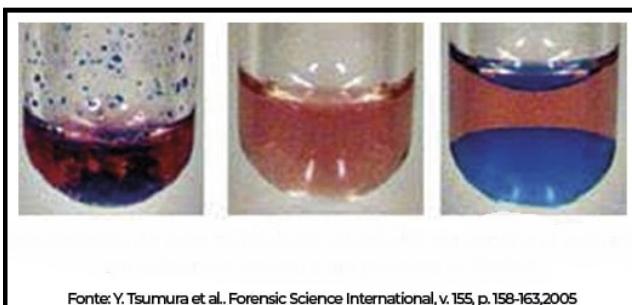
containing glycerin which, upon contact with the drug, develops a blue color, based on the same principle as the cobalt thiocyanate test. In the second stage, drops of concentrated hydrochloric acid are added, which will cause the solution to change color from blue to pink (original color of the reagent). In the last step, chloroform is added, causing the complex between cocaine and cobalt to migrate to the organic fraction, reappearing the blue color in the lower portion of the medium.

This test has good sensitivity, reacting with well diluted samples, however, it can react with other drugs such as diphenhydramine hydrochloride, chlorpromazine hydrochloride, promazine hydrochloride, scopolamine, dibucaine hydrochloride, promethazine and phencyclidine hydrochloride, powdered milk and yeast.<sup>2</sup> Due to the possibility of a false positive result when other substances are analyzed, it is necessary to use spectroscopic techniques such as UV-VIS and/or ATR-FTIR as colorimetric solutions can act as a safe analytical method to eliminate inconclusive results or resolve problems of false positives. Furthermore, the use of the ATR-FTIR technique combined with PLS multivariate calibration is a promising method for quantifying the cocaine hydrochloride content in cocaine samples seized by the Brazilian police. It is always important to emphasize that the examination is only a presumptive examination, serving only to guide the Coroner on possible findings during the autopsy examination.

In the table below, we demonstrate the phases of the Scott Test.

<sup>2</sup>Tsumura Y, Mitome T, Kimoto S. False positives and false negatives with a cocaine-specific field test and modification of test protocol to reduce false decision. *Forensic Sci Int*. 2005;155(2–3):158–164.

## Scott test result



Fonte: Y. Tsumura et al. *Forensic Science International*, v. 155, p. 158-163, 2005

Representation of the cobalt thiocyanate test in cocaine (on the left), in sugar (in the center), and in procaine (on the right)

In our country, we use the modified test, using only Ammonium Thiocyanate and Cobalt Chloride which, in an immediate reaction, give the substance studied a cobalt blue color. In cases of positivity, with a blue color identified, the test is presumptive for the substance cocaine.<sup>3</sup> Once the pre-test sample is positive, the rest of the material is separated, properly collected and stored; being sent for toxicology examination, as well as blood and fragments of viscera, providing elements for the certainty of the analyzed substance.

## Routine

In the case of death due to violent death, there is a legal obligation to carry out a medical-legal examination, and, if the suspicion falls within the scope of poisoning, a toxicological examination is requested.<sup>4</sup> Poisonings can be classified as criminal, legal (in the case of the death penalty), accidental (food poisoning, animal bites, accidental absorption of household products, medicines, among others) or voluntary (self-inflicted injuries, drug addiction, therapeutic). Depending on the objective of the case in question and the type of analysis intended, the most appropriate sample is selected and collected, the sample of choice for a given toxicological analysis. The biological samples that are the focus of toxicological analyzes routinely contain fragments of viscera, biological fluids obtained at necropsy. Within the scope of PCERJ, fragments of viscera are routinely collected, preferably the brain, stomach with contents, liver with gallbladder, kidney; Blood samples and, when possible, urine are also collected.

## Action of cocaine in the body

According to the Unodc World Drug Report 2022, around 284 million people between the ages of 15 and 64 used drugs around the world in 2020, an increase of 26% compared to the previous decade. In Brazil, consultations related to the consumption of hallucinogens grew 54% between the months of March and June 2022 when compared to the same period last year, according to data from the Unified Health System (SUS) made available by the Ministry of Health.<sup>5</sup> In Brazil, 11,071 deaths were recorded in 2020, an increase of 24.2% compared to 2019, when the country had recorded 8,917 deaths resulting from drug use.<sup>6</sup> Given such an alarming situation, it is expected that the

<sup>3</sup>Vitor NC, Lindamara MS, Bianca BM, et al. Study of the Scott test using spectroscopic techniques: an alternative method for detecting cocaine hydrochloride and its adulterants. *Química Nova*. 2014;37(9).

<sup>4</sup>Jorge Paulete V. *Toxicological Examination of Human Remains: Toxicological Analysis of Biological Material for Forensic Purposes*. Vlex. 2016. p. 689-723.

<sup>5</sup><https://www.metropoles.com/brasil/%20production-and-consumption-of-cocaine-break-record-during-pandemic-says-un>

<sup>6</sup><https://www.bemparana.com.br/noticias/parana/mortalidade-relacionada-ao-uso-de-alcool-e-outras-drogas-bate-recorde-no-parana/>

number of deaths resulting from the use of drugs, especially cocaine, will increase proportionally. Therefore, these deaths will, without a doubt, be investigated and will end up in a morgue, and will then be studied by a Coroner. It is known that several complications are associated with cocaine abuse, the most frequent being cardiovascular, respiratory, neurological and gastrointestinal effects.

In the cardiovascular aspect, cocaine induces an increase in heart rate and ventricular contractility, causing an increase in blood pressure levels. Simultaneously, epicardial arterial vasoconstriction occurs, decreasing the oxygen supply to this organ. This vasoconstriction is due to the stimulation of adrenergic receptors, the release of endothelin and the decrease in nitric oxide production.<sup>7</sup> These changes can lead to cardiac arrhythmias, tachycardia, ventricular fibrillation, myocardial ischemia, cardiomyopathies, acute myocardial infarction and death. From a Legal Medical point of view, the finding of visceral manifestations competing with asphyxial phenomena is a frequent finding in these cases, such as the presence of petechiae, fluid and dark blood, polyvisceral congestion, among others. In view of this finding, to allow a better interpretation of the autopsy findings, in these cases of death without an apparent cause, we began, in the cases already exemplified, to perform the modified Scott test in the autopsy room and, its positive result, allowed us to understand more naturally the possible cause of the etiology of the findings and the death event.

## Presentation of the technique

When starting the necropsy examination, with the use of a flashlight, in suspected cases, we investigate the nasal and oral cavities; In the event of identification of a foreign substance, it is collected using SWAB, with more than one always collected to perform the modified Scott test and the second, together with blood and viscera, sent to the sector of toxicology, to carry out an indeterminate toxicology research examination.

In the engraving available alongside, we demonstrate the findings when investigating the nasal cavity, using a flashlight, for a suspicious substance.



In the engraving available alongside, we demonstrate the collection, with SWAB, of a suspicious substance from the nasal cavity.



<sup>7</sup>Rui Fernando R. *Cocaine is responsible for 25% of AMI cases in patients between 18 and 45 years old*. CREMESP Information. 2004.

In the engraving available alongside, we demonstrate the results of the modified Scott test, of a suspicious substance in the nasal cavity.



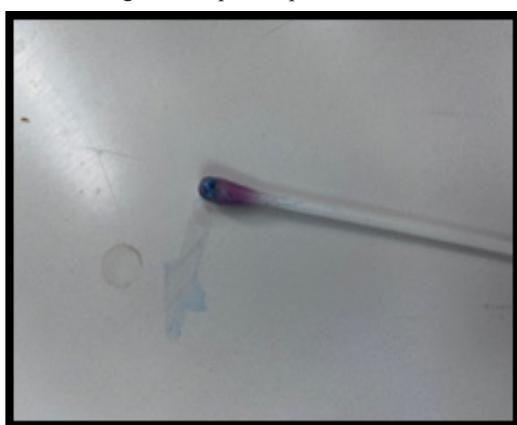
## Case presentation

Male corpse, which was admitted with head trauma and, on his face and left nostril, a white substance was identified which, collected and analyzed by the modified Scott test, acquired a blue hue, which generates presumption for the substance cocaine.

In the engraving available alongside, it is possible to identify, inside the left nasal cavity of the corpse, adhered to the mucosa, the white substance that was collected (red circle).



In the engraving available alongside, it is possible to identify, in the SWAB where the white substance that was collected, the appearance of a blue hue, which generates presumption for the substance cocaine.



## Casuistry

During 2022, we had the opportunity to carry out, in three cases, the modified Scott test, obtaining positivity for the substance analyzed, helping to identify the cocaine substance; in all cases, they were blood and viscera samples were sent to the toxicology sector of the Instituto Médico Legal Afrânia Peixoto.

The necropsy findings were below Table:

Cases examined	03 cases
Prior hospital care	02 cases (arrival in cardiorespiratory arrest with resuscitation maneuvers)
sex	Masculine: 02 Feminine: 01
Age	02 cases in the third decade 01 case in the sixth decade (traumatic brain injury)
Presence of suspicious substance in the nasal cavities	03 cases
Presence of foam mushroom in the oral cavity	01 case
Presence of cerebral edema	02 cases
Traumatic Brain Injury	01 case
Trachea with light compromised by reddish foamy liquid substance	03 cases
Presence of Lung Petechiae	03 cases
Presence of Cardiac Petechiae	03 cases
Presence of a white area in the left ventricle, elastic to the touch, suggestive of fibrosis	03 cases
Presence of Polyvisceral Congestion:	03 cases
Presence of fluid and dark blood	03 cases
Confirmation of the substance by the Toxicology sector	02 cases; 01 case was not confirmed in the blood, in the case of TBI – no examination of the SWABS sent was carried out

## Discussion

The work presented here is an idea, which was put into practice, in a Regional Post in the city of Niterói, of the Scientific Technical Police of the Civil Police of the State of Rio de Janeiro, as a way of helping the Coroner, when faced with a case of exogenous intoxication, serving as a bias in the face of necropsy findings, guiding the diagnosis of the etiology of the death result.

The Scott test used by the Brazilian Civil and Federal Police to identify cocaine in samples of street drugs can lead to false-positive or inconclusive results when substances such as lidocaine, promethazine, powdered milk and yeast are present. Despite this possibility of a false positive, we believe that, in suspected cases, when there is the possibility of collecting material from the natural orifices of the face, of a suspicious substance, our opinion is that positivity by the modified Scott exam serves as help identify possible autopsy findings that are associated with cocaine abuse. The material in the natural orifices of the face is unlikely to be powdered milk or yeast. Continuing, positivity by the modified Scott test must always be confirmed with the use of spectroscopic techniques such as UV-VIS and/or ATR-FTIR to colorimetric solutions and must act as a safe analytical method to eliminate inconclusive results or resolve false-positive problems. Furthermore, the use of the ATR-FTIR technique combined with PLS multivariate calibration is a promising method for quantifying the cocaine hydrochloride content in cocaine samples seized by the Brazilian police. All cases in our series were sent samples of blood, viscera and material collected from the nasal cavities to the Toxicology sector of the Legal Medical Institute to confirm what was found in the necropsy room.<sup>1-3</sup>

## Conclusion

From the present study, we concluded that carrying out the preliminary examination in the necropsy room with a modified Scott test proved to be viable, always carried out by a Criminal Expert, a valid conduct, guiding the Coroner in the face of the necropsy findings and the result of death in cases of exogenous cocaine intoxication.

## Acknowledgments

None.

## Conflicts of interest

The authors report no conflict of interest.

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3. Rodolfo Luis K. *Mortality related to the use of alcohol and other drugs breaks record in Paraná*. 2020.