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CASE REPORT

Case report

Case history. "Coral snake" *Micrurus mipartitus* bite in 1968. A herpetologist's ordeal☆

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ABSTRACT

Historical clinical case that presented back in 1968 at a time when respiratory support and intensive care techniques were just emerging, with many shortcomings in hospital care areas and monitoring devices. The case is of a 58 year-old patient, outstanding citizen, recent winner in a television contest on snakes, who was bitten accidentally by a coral snake *Micrurus mipartitus*. The poison of this snake is a macromolecule that induces complete depolarizing muscle blockade which, if not reverted, leads to death from respiratory failure. A group of social leaders in the region managed to obtain the specific anti-venom that was not produced in the country, as well as the mechanical ventilation equipment, a negative pressure "iron lung" and a Bird Mark 7 positive pressure device. Manual ventilation was initiated by the anaesthesia team with the support of the medical students. Then, with the Bird Mark 7, the patient survived under empirical "intensive" care after 17 days of respiratory depression and 33 days in the hospital. Voluntary contributions of the community in an effort to solve the clinical problem are narrated.

Caso clínico histórico. Mordedura de serpiente "rabo de ají" en el año de 1968. Viacrucis de un herpetólogo

Palabras clave:
Historia
Cuidados intensivos

RESUMEN

Se presenta un caso clínico de carácter histórico, sucedido en el año de 1968, época de un desarrollo incipiente de las técnicas de soporte respiratorio y cuidado intensivo, con deficiencias de los sitios de atención en el hospital y en equipos de monitoreo. Paciente de 58 años, líder cívico, ganador de un concurso de televisión sobre ofídicos, es mordido

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CASE REPORT

Antídotos
Mordeduras de serpientes
Insuficiencia respiratoria

accidentalmente por una culebra "Rabo de Ají" *Micrurus mApartitus* cuyo veneno es una macro molécula que produce un bloqueo muscular completo tipo despolarizante que de no ser resuelto, el paciente muere por insuficiencia respiratoria. Un movimiento cívico de la región logra conseguir el antídoto específico que no se producía en el país y los equipos de ventilación mecánica, uno de presión negativa un "pulmón de acero" y otro de presión positiva un Bird Mark 7. Se inició ventilación manual con el equipo de anestesia y estudiantes de medicina, y luego con el Bird Mark 7 el paciente sobrevive a un cuidado empírico "intensivo" después de 17 días de depresión respiratoria y 33 días de hospitalización. Se narran aportes voluntarios de la comunidad en apoyo a la resolución del problema clínico.

Clinical and medical conditions at the time

There were 3 hospitals in the city of Manizales, in the Department of Caldas: Caldas Hospital, training centre for healthcare professionals (physicians and nurses) and home to the fledgling anaesthesia specialty programme; Santa Sofía Hospital, previously the tuberculosis institution later turned into a general hospital; and the Children's Hospital focused on paediatric care.

In the second half of the 1960s, the first two could be designated as level III hospitals. There was healthy competition between them for leadership in the care of critically ill patients. The Santa Sofía Hospital developed care programmes for chronic pulmonary patients and sought to specialize in surgical care of patients with heart disease, an aim that was eventually consolidated in the latter years of the 20th century. On the other hand, the Caldas University Hospital, because of its prestige and strategic location in the city, received the most acutely ill patients, including trauma patients.

In Manizales, the development of critical care for special, postoperative and critically ill patients dates back to 1963 when the first "Recovery room" was set up in a corner of the surgical area of the University Hospital. It was equipped with two beds and nurse "aides" (professional nurses were practically non-existent and the training of "licensed practical nurses" was just starting) who trained specifically for that purpose. Thus began anaesthesia recovery care in patients undergoing more complex surgical procedures. The other patients were managed as "best as possible" in the operating room before they were transferred to the floor where they would wake from anaesthesia. In the recovery room, monitoring was basic: blood pressure, pulse, respiratory rate and careful clinical observation, with no expectation of special care. By 1965, after the author returned from additional specialized anaesthesia training in Mexico, this room was made bigger and equipped with four beds. Central venous pressure monitoring had come on stage and an Electrodine cardiac monitor had become available, although it spent more time in the repair shop than in operation. It was the time of cyclopropane and ether-based anaesthesia, succinylcholine and the dawn of d-tubocurarine; halogenated agents and halothane (Fluothane^{r}) were already in use, but the need to purchase the vaporizer and to pay for the high cost of the anaesthetic meant that they were not a practical option.

Mechanical ventilator support was non-existent, and blood gas monitoring was a dream in process. Cardiorespiratory resuscitation was evolving towards cardiac massage, airway protection and mouth-to-mouth breathing.

Social background of the clinical case

It was October 1968 and in the black-and-white TV screen, the show "20 000 pesos for your answer"[1] had just come to an end. Gilberto Villegas Velásquez (Givive),[2] 58, was a lawyer and an important public man, well known in the city because of multiple projects and programs developed under his leadership for the good of the community, had just managed to win the contest, having been the first participant to do so. Mr. Villegas had participated with the subject of the study of snakes and had enthralled the audience with a fascinating live show of a wide variety of these reptiles, and descriptions of their characteristics, habits and dangers.[3,4]

Within a few days, Mr. Villegas' home in Manizales became the destination of all kinds of snakes that people brought in for their identification. One day, at 6 p.m., as he returned home, he found a 4 year-old neighbour playing with a small snake brought to him for identification. He immediately recognized it as one of the most venomous coral snakes whose poison was a toxic muscle relaxant. Afraid that the snake could bite the child, he snatched from him (as he said after he recovered) and the snake bit him on his right ring finger. A very special characteristic of this snake is that it does not attack if left alone; in fact, farmers in the coffee growing region always turn their boots upside down every the morning in order to shake out snakes and scorpions. Failure to do this, and should a snake of this type have made a home in the boot, a bite is certain.[5,6]

The *Micrurus mipartitus* coral snake

The *Micrurus mipartitus* coral snake belongs to the Elapidae family, characterized by the most toxic venoms among all terrestrial snakes, and consists of two subfamilies – elapidae and hydrophinae, the first one represented in America by the poisonous coral snakes of the Micrurus genus.

There are more than 50 classes of snakes in this genus, also called *Coralillas* or *Gargantillas*, their main characteristics being an average length of one meter, a uniformly cylindrical body,

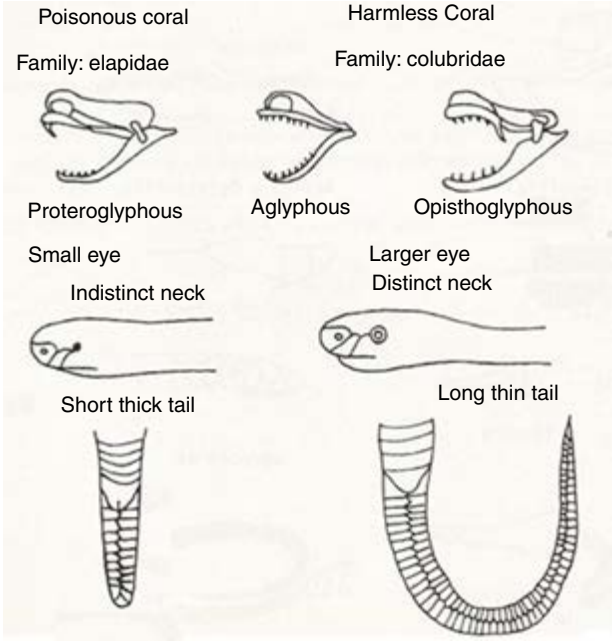

Fig. 1 – Characteristics of the snakes of the Elapidae family compared to other non-poisonous genera.
Source: Modified from Serpientes de Colombia by Rodrigo Ángel Mejía.[8]

Fig. 2 – "Rabo de Ají" coral snake[9].
Source: Taken from[9].

indistinct neck, short thick tail, and small beady eyes with a vertical pupil[7] (Fig. 1).

Their rings are black, red and white (yellow), they are outstandingly agile and when bothered they react with sudden fast movements. ***Micrurus mipartitus***, colloquially known in Colombia by the names "*Rabo de Ají, Rabo de Candela, Cabeza de Chocho*", is perhaps the most important of all venomous corals in the coffee growing area of the country (Fig. 2).

It is considered a proteroglyphous snake (Fig. 3) because of its long maxilla at the end of which it exhibits a short curved fang turned inwards that is perforated in the inside and communicates with the poison gland. The orientation and length of the fang is not greater than 2 or 3 mm, giving rise to the assumption that the venom, when inoculated, remains on the surface of the tissue, and that a large amount of it could be removed by means of prompt vigorous suction from the inoculation site, thus reducing the intensity of the toxic reaction.[8]

The neurotoxins inoculated by this coral snake belong to the group of post-synaptic acetylcholine receptor blockers. They are macromolecules with a basic pH of 9 and have a similar action to that of curare (d-tubocurarine), but they bind more tightly to the acetylcholine receptors, giving rise to a flaccid paralysis that compromises breathing and results in death. The anti-venom, anti-ophidic serum, for the bite of this class of Micrurus is momovalent and specific for this coral. Polyvalent sera have no action against the pathologic effects of the venom.[8,10]

Initial clinical course

When Givive realized what had happened, he called his brother, Dr. Jaime Villegas Velásquez, outstanding surgeon and physician, and informed him that the bite was deadly, that there was no antidote in Colombia for the poison of that snake, and that everything was lost. As part of the instructions he gave before the onset of the symptoms, he told his brother that the specific serum was only available in Butantan, Brazil.[11] Despite the remarks of the expert, Dr. Jaime Villegas asked the serpentarium in Armero, Tolima (town that years later would disappear under the mudslide caused by the eruption of the Ruiz volcano) to find the polyvalent antio-phidic serum anyway, even though it would be useless according to Gilberto's opinion. Jaime travelled over land from Manizales to Mariquita to fetch the serum and, half way, at point on the road called "Delgaditas", met with the technicians who were driving from Armero. He turned back and administered the antidote to his brother.

It was 1 a.m., symptoms of respiratory distress were becoming more evident, and Gilberto demanded to be taken to the hospital because his only hope was to be put on assisted ventilation. At 6 a.m. the author was on duty in the operating room when a crowd rushed into the hospital, headed by the parish priest of the Estrella neighbourhood where Mr. Villegas lived. He was walking along the stretcher, giving him the last rites and reciting the prayers of death, because the patient had informed him that there was no cure.[2] Mr. Villegas' brother was also there and gave the physician in the operating room a detailed description of what had happened, although the physician also knew the story from the bits and pieces of rumour that had reached the hospital.

The patient was anxious, cyanotic, in respiratory distress and he made signs and utterances in the sense that he needed help with his breathing if he was to survive. Manual ventilation was initiated right away after uneventful orotracheal intubation, with the support of the anaesthesia machine. It was a desperate situation. There was only a small post-anaesthesia recovery room poorly equipped to handle such a case. Industry had already been asked for a donation of a Bird Mark 7 ventilator but it was on the way and there were no resources for prolonged ventilation.

A strong argument ensued regarding the best way to manage the patient's ventilation. Dr. Manuel Vanegas, prestigious

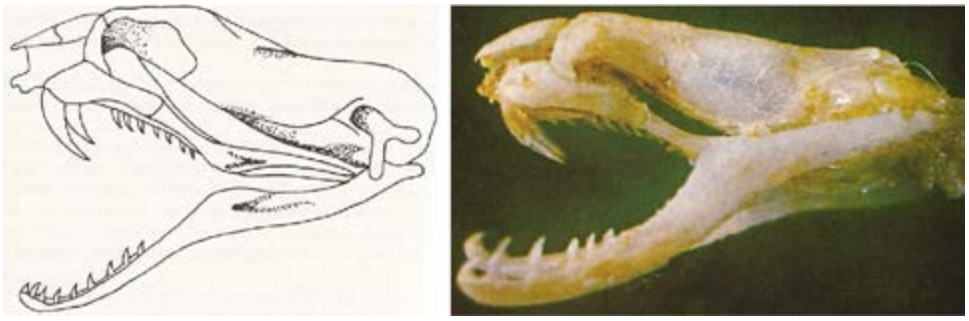

Fig. 3 – Proteroglyphous skull of the *Micrurus mipartitus* coral snake.
Source: Modified from *Serpientes de Colombia* by Rodrigo Ángel Mejía[8].

thoracic surgeon and his team at Santa Sofía Hospital, asked for an "iron lung" (of the type used during the polio epidemic in the Nordic countries) in order to provide external negative pressure ventilation. On the other side of the debate were Dr. Ocampo and his team who proposed management with positive pressure ventilation to the airway. None of the two devices were available in the city. Shifts were set up to provide continuous manual ventilation using the anaesthesia machine. Medical students were selected and given instructions by supervising attending physicians on how to ventilate and assess the patient's clinical condition. The two medical teams tried to bring their knowledge to bear in order to find the best treatment option.

Dr. Venegas had been searching for an iron lung and finally found one in a military base hospital in Panamá. This became possible because the case had made it to the media unbeknownst to those who were at the bedside, and had mobilized people at a local, national and international level (Fig. 2).[12,13] (See anecdote under Community Engagement.)

An iron lung, or **negative pressure ventilator** as it is rightly called, is a great machine that enables the person to breathe when control of muscles has been lost or respiratory work exceeds the individual's capacity.[14] The machine was invented by Philip Drinker (1894–1972)[15] and Louis Agassiz Shaw, from the Harvard School, originally for treating carbon gas poisoning. The peak of its use was in the mid 20th century during the great polio epidemics in Europe, Australia and New Zealand. In the United States, the situation had been even more critical, with thousands of cases that peaked at 58,000 in 1952.[16] The first iron lung was installed at Bellevue Hospital in New York City in 1927, and was used for the first time on October 21, 1928 at the Children's Hospital, in Boston, Massachusetts, in an unconscious girl with respiratory problems (Figs. 4 and 5).

On the other hand, given the patient's worsening condition, word was sent to Dr. Rafael Sarmiento at the Marly Clinic in Bogotá. Dr. Sarmiento had experience in the care of critically ill patients, had the equipment, and worked in what was considered at the time the first Respiratory Therapy Unit in the country. Dr. Sarmiento arrived in Manizales 4 days after the event, bringing with him his expertise, a Bird Mark 7 ventilator and an ultrasonic nebulizer. Positive pressure ventilation and respiratory therapy were instituted right away.

The Bird Mark 7 respirator, a positive pressure ventilation device developed by Dr. Forrest Bird[18] in 1967, marked the

Fig. 4 – Iron lung brought in for the care of Mr. Villegas.[17]
Source: Author's personal archive.

beginning of a series of ventilators that served as pillars for this form of support in the third world for several decades (Mark 8, Bird Ventilator, Baby Bird, etc.). Dr. Bird (1921–2015), American aviator, inventor and biomedical engineer, is better known for the creation of some of the first mass-produced reliable ventilators for acute and chronic cardiopulmonary care. In recent times, he developed the concept and principles of intrapulmonary percussive ventilation (high frequency ventilation). These principles were represented in Colombia by the work on "Reverse pressure pulses" than won its author, Dr. Manuel Venegas, the National Medicine Award in 1988.[19]

Clinical course

A new argument arose when a chest X-ray showed a totally white right lung with atelectasis. One group advocated performing a bronchoscopy (rigid bronchoscope) for the removal of a potential mucus plug to which they attributed the problem, and to clear the lower airway. This possibility was finally discarded because it was impossible to perform the procedure because of the potentially fatal consequence of interrupting ventilatory support in a patient who was not ventilating and was hypoxic and cyanotic. The other treating team advocated respiratory therapy with ultrasonic nebulization, vibration and manual percussion, plus the airway aspiration technique

Fig. 5 – Bird Mark 7 ventilator and ultrasonic nebulizer used in Mr. Villegas' care. Above: the name of the owner, Dr. Sarmiento.
Source: Author's personal archive.

brought by Dr. Sarmiento. Two days later, this intensive treatment worked, the thick mucus plugs were mobilized, and atelectasis resolved partially at the beginning and eventually resolved completely. However, the price of ventilating with the anaesthesia machine without either proper humidifying, nebulization or respiratory therapy had been paid.

Respiratory therapy with ultrasonic nebulization is based on the principle of fractionation of water particles and the use of ultrasound instead of pressurized air or oxygen to produce smaller drug particles that have the ability to penetrate deep into the airway and minor bronchi. Also, hydrated mucus plugs fluidize secretions, which are then mobilized with the help of additional therapy techniques, as was the case with the plug that caused atelectasis in this patient. Ultrasound can be used to split fluids and reduce particle sizes through the use of intense sound waves.[20]

There are stories to tell regarding the mobilization of the venom from the patient's body and the administration of the antidote. Finding the anti-venom was a true drama that involved the entire city. It arrived at the improvised critical care room six days after the accident, when the poison had already caused damage and its effectiveness was in doubt.[21] (See anecdote in "Community Engagement".)

The use of clinical therapeutic measures to "remove" the venom from the patient's body, as the only hope for recovery, became the number one priority. The review of the scientific literature revealed that the venom was a macromolecule that was cleared through the kidneys. This prompted the team to implement the strategy of achieving adequate hydration and good urinary output in order to help the poison find a way to exit the body once it was mobilized to the muscle plate. Central venous pressure monitoring played a key role as one of the few hemodynamic parameters that could be measured at the time.

The patient was monitored on the basis of clinical manifestations: auscultation, peripheral perfusion, oxygenation assessment (because of cyanosis), blood pressure, and little else. "Urgent blood gases" were sent to Marly Clinic in Bogotá, where Dr. Sarmiento had access to one of the first blood gas analyzers available at the time in Colombia. The results came back 2 days after the sample was taken, but had little influence on management, given that the clinical conditions had changed.

Nutrition was managed empirically through a nasogastric tube, and patient mobilization was assured in order to avoid pressure ulcers, by means of flawless nursing care. Airway management after day 5 was done through a tracheotomy, using an inflatable balloon cannula that had to be delivered from the United States (by an alumnus of the medical school) because the device was not available locally and was out of stock in Bogotá.

Care was provided at the bedside for 17 days. The patient gradually recovered the ability to breathe independently and, after one month, was finally discharged from the hospital.[22] After his recovery, Mr. Villegas provided important written insights regarding the management of this critical situation,

things that were not taken into consideration during the management of his own case. Regrettably, there is no record of those recommendations. The state of consciousness was a critical issue. Although attempts were made at sedation in order to "disconnect" the patient from the environment, he was not sufficiently sedated and described heartrending situations of anguish that he experienced while he was paralyzed. He was shocked by the fact that he had to lie naked for daily cleansing by the nurses, by the cold in the "recovery" area, and his inability to communicate his discomfort.[2]

The patient came back two years later because of a brain aneurism, and 6 years after that he died from a stroke.

Anecdotes regarding the participation of the community in the case

The engagement of the community in the case of this patient was exceptional. He was greatly respected because of his commitment to solving social problems. His appearance and great performance in the television show made him famous, having been the first contestant to win the big prize.[3,23]

The first mobilization came from witch doctors, shamans (Annex 1), naturopaths, and all sorts of people who believed they had the cure for snakebites in general, but who could not come up with a specific solution for the bite of this coral snake. All kinds of treatment proposals were forwarded to the hospital and to the operating room.[24]

The other story in this case has to do with the journey of the iron lung. It left Panama on board a US Army Camberra plane but landing in Bogotá was not possible because permission was not granted. Landing in the small Manizales airport was out of question, as was also the case in nearby Pereira, despite its somewhat larger airport. The machine had to be put on another aircraft that could land in Pereira, and arrived in Manizales 10 days after the snakebite event. The machine was later donated to the institution where it is kept as a museum piece (it was used once at Santa Sofía Hospital to treat a Guillan Barre patient).[17,25]

It was later told that the need to communicate with Butantan (Annex 2), something almost impossible at the time, mobilized "radio amateurs" far and wide, under the leadership of laboratory technician Carlos Arturo Valencia. When the serum was localized, it arrived in Bogota from Brazil at 5 p.m. A small aircraft that could land at La Nubia airport, procured as a result of the pressure from the community and the press, was to bring the serum to Manizales immediately, but the landing strip had no lighting. Again, the people mobilized and parked more than 100 cars on both sides of the landing strip, headlights on, to help with the landing. The serum finally arrived at the second floor of the hospital and the makeshift ICU at 10 p.m. but it was no longer of any use because the venom had reached the patient's muscle plate and had been causing its deadly effect for 5 days. A historical civic milestone had been etched in the annals of the city. The pilot who had accomplished the feat was decorated by the city Mayor and given a suspension by the Civil Aeronautics Authority.

This is the story of a patient with a disease for which there were no local resources, but who lived thanks to social and scientific mobilization, and who went on to become the "first intensive care patient in the region".

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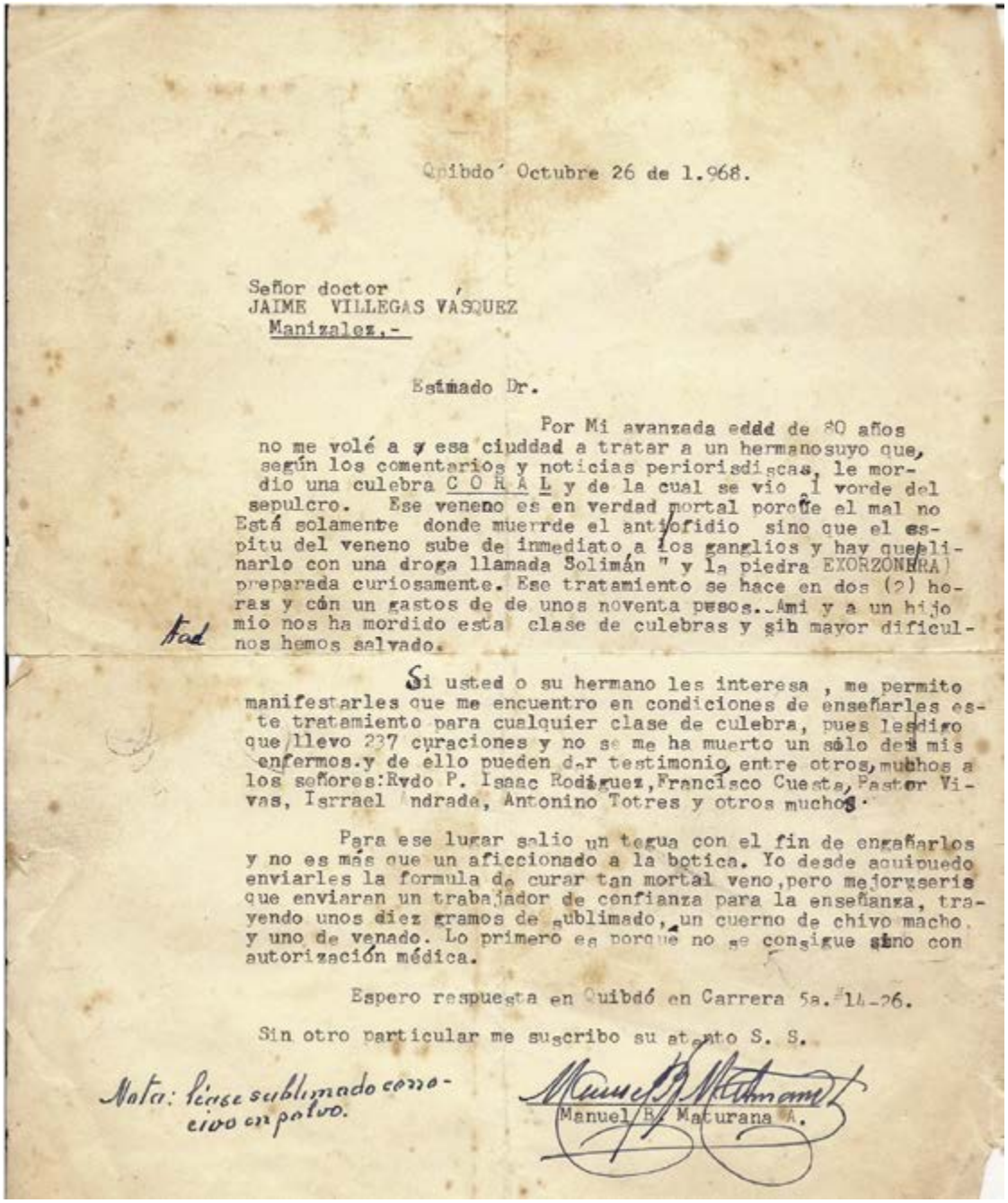
Conflicts of interest

The author has no conflicts of interest to declare.

Annex 1.



Quibdó Octubre 26 de 1.968.

Señor doctor
JAIME VILLEGAS VASQUEZ
Manizalez.-

Estimado Dr.

Por Mi avanzada edad de 80 años no me volé a y esa ciudad a tratar a un hermanosuyo que, según los comentarios y noticias periodísticas, le mordio una culebra C O R A L y de la cual se vio al borde del sepulcro. Ese veneno es en verdad mortal porque el mal no Está solamente donde muerde el antiofidio sino que el espitu del veneno sube de inmediato a los ganglios y hay que eliminarlo con una droga llamada Solimán " y la piedra EXORZONERA) preparada curiosamente. Ese tratamiento se hace en dos (2) horas y con un gastos de de unos noventa pesos. Ami y a un hijo mio nos ha mordido esta clase de culebras y sin mayor dificultad nos hemos salvado.

Si usted o su hermano les interesa , me permito manifestarles que me encuentro en condiciones de enseñarles este tratamiento para cualquier clase de culebra, pues les digo que llevo 237 curaciones y no se me ha muerto un sólo de mis enfermos.y de ello pueden dar testimonio, entre otros, muchos a los señores:Rvdo P. Isaac Rodriguez,Francisco Cuesta, Pastor Vivas, Israel Andrade, Antonino Torres y otros muchos.

Para ese lugar salio un tegua con el fin de engañarlos y no es más que un aficcionado a la botica. Yo desde aquipuedo enviarles la formula de curar tan mortal veno,pero mejorseria que enviaran un trabajador de confianza para la enseñanza, trayendo unos diez gramos de sublimado, un cuerno de chivo macho y uno de venado. Lo primero es porque no se consigue sino con autorización médica.

Espero respuesta en Quibdó en Carrera 5a. 14-26.

Sin otro particular me suscribo su atento S. S.

Nota: Lleve sublimado corrosivo en polvo.

Manuel B. Maturana A.

Source: Author's personal archive.

Letter from shaman Manuel Maturana offering his services

"Owing to my old age, 80 years, I did not fly right away to your city to provide treatment to a brother of yours who, according to the news, was bitten by a CORAL snake that put him on the edge of his grave. This venom is indeed deadly because the disease is not just at the bite site but the spirit of the poison travels immediately to the lymph nodes and needs to be removed with a drug called "corrosive sublimate" carefully mixed together with *EXORZONERA* stone. The treatment is done in two hours for an approximate cost of ninety pesos. My son and myself have been bitten by those types of snakes and we have survived with not much difficulty.

Should you and your brother be interested, I am in a position to teach you this treatment for any type of snake bite. I have cured 237 patients, none of whom have died. People like Reverend Isaac Rodriguez, Franciso Cuesta, Pastor Vivas, Israel Andrade, and Antonino Torres, among many others, may bear witness to this.

A fake doctor has traveled to your city to deceive you. He is nothing but an amateur druggist. I can send you the formula to cure the deadly poison, but it would be better if you could send

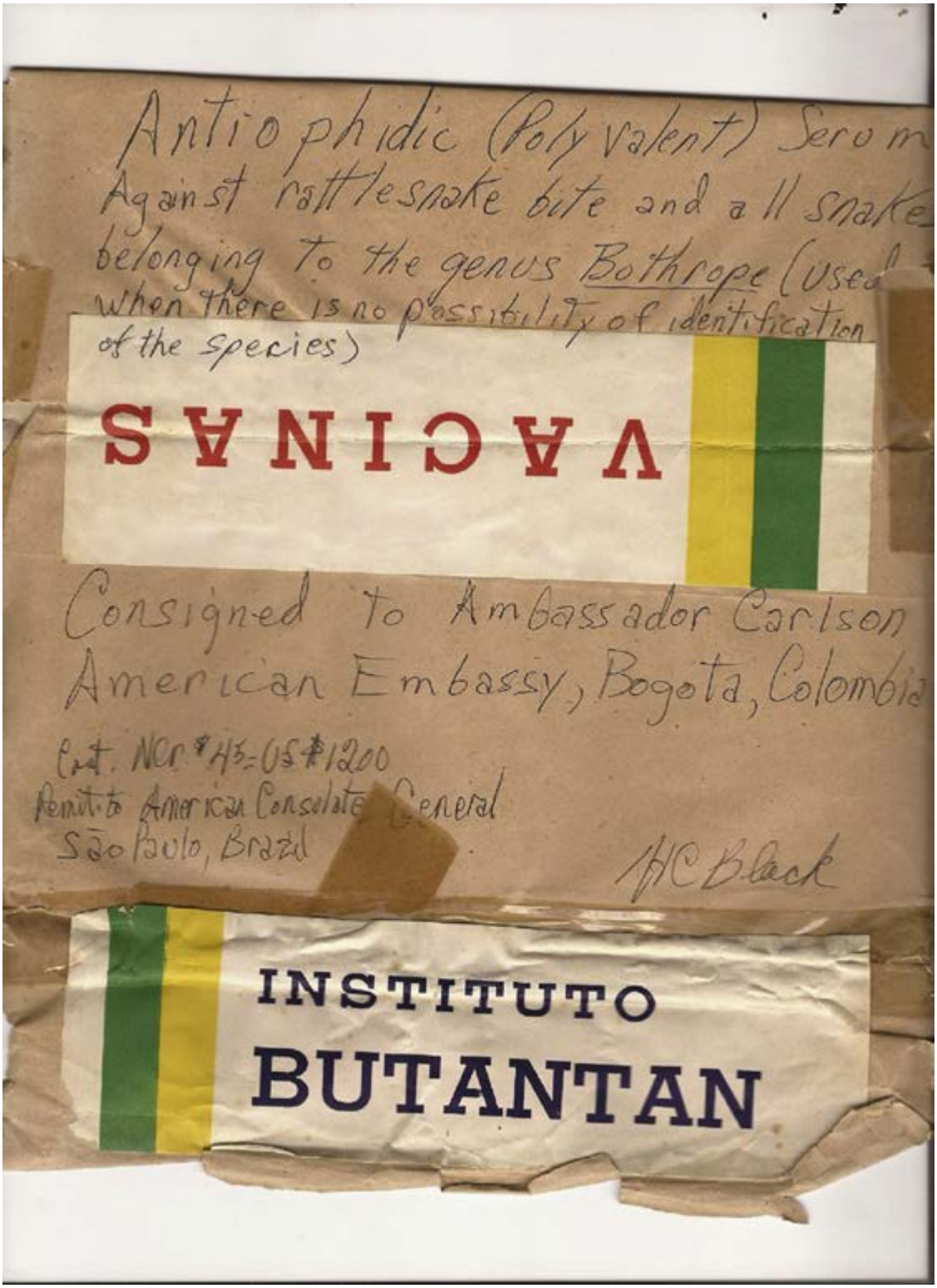
a trusted worker who must bring 10 grams of sublimate, a horn of a male goat, and a deer horn, and I will teach him. The first ingredient can only be obtained with medical authorization.

I look forward to your reply at Carrera 5a #14-26, Quibdó.

Sincerely,

Manuel B. Maturana

Annex 2.



Source: Author's personal archive.

Upper side of the envelope that contained the anti-ophidic serum sent by the Butantan Institute in Brazil.

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