

# Food Botulism: Nursing Actions to the Patient that Evolved with Acute Kidney Insufficiency in the Intensive Care Unit

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**Abstract**— It is understood that botulism is a serious disease, whose toxin released by the bacterium *Clostridium botulinum* causes a neuromuscular action, requiring that the affected patient needs intensive care. As a consequence of the long period of hospitalization, the patient is subject to complications, which include risk of shock and electrolyte imbalance resulting in Acute Renal Failure (ARF). **Objective:** This study aims to present the clinical complications developed by the patient that occurred from botulism poisoning and to identify the clinical causes that led the patient with botulism to ARF, establishing the relationship of these causes with the signs, symptoms and laboratory results. **Materials and Methods:** A descriptive, cross-sectional, retrospective and qualitative study was conducted based on secondary data collection, with documentary data collection in the form of a case study regarding a patient admitted to the ICU of the Regional Hospital of Cacoal - RO, victim of food poisoning. **Results:** The gastrointestinal symptoms characteristic of botulinum disease, arise in hydroelectrolytic disorders (Renal Hypoperfusion), where added with extended hospitalization and septic conditions are conditions for complications and ARF within intensive care. **Final Considerations:** It is noted that botulism associated with kidney disease can become a serious condition with imminent risk. In the Intensive Care Unit, a skilled and active nursing team becomes a differential in order to avoid conditions that further aggravate the patient's clinical condition.

**Keywords**— Botulism. Acute Renal Failure. Intensive Nursing. Intensive Care.

## I. INTRODUCTION

Botulism is a sickness caused by the action of a strong neurotoxin produced by the gram-positive endospore bacteria: *Clostridium botulinum*, which is mainly related to canned food with low rates of acid such as the case of corn, beet, green beans and asparagus among other (Bezerra *et al.*, 2016).

The first scientifically proved case of botulism happened by the end of the 16<sup>th</sup> century at Central Europe where an intoxication happen after the consumption of sausages, which in Latin means *botulos*, thus originating the name of the pathology. the disease-causing microorganism was once more identified in 1897 at Belgium, when 23 people got sick and 3 died due to complications of the pathology, the type A toxin was identified in them. A couple of years after, in 1904 the type B toxin was identified .

The symptoms that can initially show include gastrointestinal symptoms (nausea, vomiting, diarrhea and abdominal pain) and neurological symptoms (headache, vertigo and dizziness). The descending flaccid motor paralysis can also show, which is related to the widespread autonomic impairment. The symptoms begin in the nerves and evolve downward through the body, which grants the botulism a differential when related to the Guillain Barre syndrome where a severe paralysis shows upwardly. Compromising the cranial nerves, comes the blurred vision, Uni or bilateral eyelid ptosis, difficulty converging the eyes and diplopia, as there is paralysis of the extrinsic musculature of the eyeball. In the evolution of the disease, the muscles of the trunk and limbs are paralyzed, which can lead to dyspnea, respiratory failure and flaccid quadriplegia. The toxin causes neuromuscular block, so the deep or osteotendinous reflexes are reduced. A peculiar characteristic related to botulism is the preservation of the level of consciousness (Ministry of Health BRAZIL, 2006).

Due to be a sickness which demands intensive care for the recovery of the sick, there is the possibility that comorbidities related to clinical manifestations and hospitalization period to show. Therefore, we have the Acute Renal Failure (ARF) as study subject, since it is related to the hydro-electrolytic imbalance present in those patients, being of high incidence in Intensive Care Unit (ICU) (Santos &Marinho, 2013).

The complexity of the care is a striking factor of an Intensive Care Unit, which creates uncertainty conditions related to the clinical condition faced, and frequently related to a cold, aggressive and traumatizing environment. Due to the physical characteristics of the ICU with

equipment, materials and technologies in general, a mechanized behavior can show in the team, marked by the absence of simple attitudes such as a smile or a handshake (Abrão *et al.*, 2014).

In the face of those problems, the nurse along its team should provide care under a clinic reasoning, evaluating the client as a whole and identifying possible complications trying to reduce incoherence (Santos &Marinho, 2013). The care offered by the nurse is fundamentally based on necessities, thus the nursing method and process comes from Basic Human Needs (BHN), which can be provided by an attentive and trained caregiver, in order to grant the survival of the individual or group (Petersen *et al.*, 2016).

Despite the advances in technology related to the serious patient care and the dialysis techniques, the Acute Renal Failure is considered one of the most important complications related to hospitalization. Due to the characteristics of the patients seen in the ICU, the place registers the largest number of Acute Renal Failure incidence (20 to 40%), when compared to an intermediate care location (1 to 7%). Among the admitted to the ICU, 5,7% evolve to Acute Renal Failure and demand dialysis. Through recent years there was a drop in the mortality rate by the sickness, although the level is still high, reaching an average of 50%, this happened due to late diagnosis, absence of risk factors identification and lack of knowledge about the factors related to the mortality (Ponce *et al.*, 2011).

The early identification of the sickness becomes a challenge to the public health, because it presents many etiologies, conducting to azotemia, which configures as an increase of the plasma urea and creatine levels, due to the reduced glomerular filtration level. It can be caused by hemorrhage, heart failure, sepsis, myocardial infarction (pre-renal causes), nephrotoxic agents, prolonged ischemia, infectious processes (intra-renal causes) and obstruction of the urinary tract (post-renal cause). According to Acute Kidney Injury Network the serum creatinine levels and urine output are criteria to define the Acute Renal Failure diagnosis (Santos e Marinho, 2013).

According to Luft *et al.*(2016), the patients in intensive care are frequently submitted to vasoactive drugs, such as the vasoconstrictors which are one of the possible causes of kidney injury. The hemodynamic instability caused by these medications generates a risk factor of mortality in intensive care.

Therefore this research will contribute on determining the relation between botulism, the received treatment and the acute renal failure in a young woman seen at a referral

hospital from the State of Rondônia. By that means the nursery team and other health professionals will be able to early identify and better determine the best conduct, specially when related to botulism which is a low-incidence and high severity disease, that carries the possibility of drastic complications. The acting team in the ICU will be able, with this material, to have a better understanding of how the ARF appears and determine measures to avoid the emergence of or to minimize the complications.

Knowing that, this study becomes necessary for the objective to reveal the clinic case of a patient with exogenous botulism intoxication, who developed Acute Renal Failure (ARF) in the ICU, the complications from the botulism intoxication and the nursery assistance provided through hospitalization. Identifying the causes that took the botulism patient to the acute renal failure, establishing the relations of these causes to the signs, symptoms and laboratory results.

## II. METHODOLOGY

This is a descriptive documentary, transverse, retrospective and qualitative study that occurred based on secondary data gathering, in the form of case study. The research was based on a specific fact, being the patient chosen due to a singularity of the presented Botulism clinical condition and her evolution to the treatment, providing the research with a relevance content on the face of the unexpected situation that the sickness brings.

Initially it was presented to the patient and her responsible the objective of the study and the Informed Consent Form (ICF) for manifestation of concordance from her over the publication of the referred study. Following that the research project was submitted to evaluation and subsequent approval by the Ethics and Research Committee (CEP) – [Translator's note: Brazilian abbreviation], FACIMED, on the Brazil Platform, option n° 3.470.587. After that, the researchers contacted the General Directorate from the HRC [TN: Regional Hospital of Cacoal], presenting the relevance and the objective of the study, besides the necessary documents to obtain the authorization for the data collection.

## III. RESULT

### 3.1. Case Report

The reported case with evidences from the Epidemiological and Health Surveillance of the State of Rondônia verified the relevant information about the present conditions of the intoxication at the residence of

the patient's relatives, this report described below is based on the report sent by the Rondônia State Health Surveillance Agency (ANGEVISA, 2019) – [TN: Brazilian abbreviation].

21 years old female patient, resident of São Miguel do Guaporé city, she participated at February 10<sup>th</sup> 2019 (Sunday) in a barbecue along eight people in a county house at the same city. Around 10:00 am they ingested home made fresh sausage as beer appetizer. From 11:00 am to 12:00 pm, the lunch for eight people was served (six adults and two children), composed by: rice, beans, roasted meat / barbecue, cooked free-range chicken, homemade mayonnaise with industrialized corn, seasoned with free-range egg, lemon and oil. Latter a packed lunch was made for 1 (one) more person. An elder (the father of the house owner) who lives alone at the urban area, and didn't participated in the barbecue. By the end of the lunch only the mayonnaise was stored in the refrigerator. At 5:00 pm dinner was served with the leftovers from lunch in which only five people ate. Around 6:30 pm, the referred patient and her husband, along the invited friends (two adults and two children) returned to their houses at the urban area, and around 11:00 pm the neuromuscular symptoms started (diplopia, eyelid ptosis, difficulty swallowing, dysarthria, dyspnoea, respiratory failure), looking for medical care in the city of origin with further transference to a referral hospital.

### 3.2. Hospitalization

Patient under study at the 20<sup>th</sup> day of hospitalization presented hemodynamic stability, without sedation since February 20<sup>th</sup>, tachycardic, normotensive, without use of vasoactive drug (VaD), breathing with help of mechanic ventilation through tracheostomy. Spontaneous eye opening; responsive to verbal commands, returning part of the muscle tone, maintaining a nasogastric tube (NG tube) diet with good tolerance, peripheral venous access in hydration, in the physical examination evaluated by the nurse, she presented a distended and hyper-tympanic abdomen, back without injuries, diuresis by bladder catheter delay of concentrated appearance and in great volume (hyperpolyuric), present evacuation of pasty and liquid aspect with 5 episodes within 24 hours, thus closing the negative water balance in -2.816ml.

The medical diagnostic established in the ICU was Food Botulism and Severe Acute Neuroparalysis. The nursing diagnostics based on Nanda International Nursing Diagnoses (Herdman & Kamitsuru, 2018) were: risk of infection related to invasive procedures; impaired spontaneous ventilation related to a clinical picture of acute respiratory failure, evidenced by tracheostomy /

mechanical ventilation; risk of impaired skin integrity related to impaired immobilization and hypothermia related to low ambient temperature and inactivity, evidenced by cold skin to the touch and tachycardia.

At the 23<sup>rd</sup> day of hospitalization the patient presented a large volume gastric return through the NG tube, with a significant drop in urine output between the last two days, but maintaining evacuation of diarrheal characteristic. There was a decrease in the level of consciousness, an abrupt drop in blood pressure and tachycardia, requiring central venous access in the right subclavian to introduce noradrenaline. At the 24<sup>th</sup> day of hospitalization remaining hemodynamically unstable, using vasoactive drug, she presented gastric return through the NG tube with the

presence of blood, persistent hyperthermia and central venous pressure of 5cmH<sub>2</sub>O. At the 25<sup>th</sup> day of hospitalization there was an increase in nitrogenous scoria and hyperkalaemia, in which a femoral catheter was introduced to start hemodialysis. At the 27<sup>th</sup> day of hospitalization hypotensive patient with vasoactive drug, presented several hypoglycemic episodes, evolves to a cardiorespiratory arrest, performed a cardiopulmonary resuscitation maneuver with response after one cycle.

The laboratory exams inside the ICU corroborate diagnostics ends along with the patient's clinic. The following chart presents the results from these exams that contributed to direct the therapeutic conduct (**Figure 1**).

*Fig.1: Laboratory exams from the patient as part of the routine in intensive care, ICU/HRC Cacoal/RO [TN: RO stands for: Rondônia], 2019.*

	Na <sup>+</sup>	K <sup>+</sup>	Urea	Creatine	Blood glucose	Hemoglobin	Leukocytes	Lactate
01/03/19	149,8	3,9	24	0,7	116	10,1	11230	12
03/03/19	150	4,4	20	0,6	132	10,5	14000	
04/03/19	146	4,6	21	0,5	120	10,8	29000	
05/03/19	143	4,2	20	0,4	156	11,2	16970	
06/03/19	145,3	5	52	1,6	89	12,4	23510	14
07/03/19	149	7,1	119	4,3	55	11,7	24400	22
09/03/19	141	5,1	150	3,6	99	8,2	26.800	23
12/03/19	134	5,2	103	4,9	94	6,3	20310	
15/03/19	130,8	4,2	49	1,9	88	9,3	25970	21
20/03/19	133,4	3,8	69	2,6	114	8,8	22300	
27/03/19	135,8	4	79	1,6	94	7,4	12460	15

**Source:** (ICU, HRC\SESAU, 2019).

The Figure 2 displays a chart exemplifying how the registration of hydric balance (HB) happened which is part of the nursery routine in ICU. The data reflects the relation between the body gains and the losses of the studied client, being them the ingestion and infusion of medicines considered as inputs and the physiological eliminations as losses.

It is observed that at the beginning point of the chart there was a considerable difference between gains and losses, the eliminations exceeded the normal physiological values, the volume replacement not being performed thus closing the negative hydric balance. A drop in the volume of diuresis happened lately and consequently the ARF, which was also a period when the patient was hemodynamically unstable thus needing hemodialysis. It is perceived that thanks to the ultra-filtered from the dialysis

sessions, it was possible to eliminate the overload of liquids due to renal failure and from March 20<sup>th</sup> at the 38<sup>th</sup> day of hospitalization, it was noticed an important return of the renal function and following that the establishment of balance in the physiological processes, organism homeostasis after all.

Through March the patient presented great hemodynamic instability, being registered by the daily nursery notes as well as by the medical prescriptions for the use of noradrenaline with a flow reaching 6,4 mcg/kg/min by which provoked skin lesions, making necessary daily care with techniques that could provide improvement of wound conditions and protection of intact skin. It evolved to a sepsis and subsequent septic shock with an unclear focus; due to low hemoglobin rate, a blood transfusion was required; the gastrointestinal immotility



confirmed by the propaedeutics of the physical examination, resulted in receiving parenteral nutrition; underwent 14 hemodialysis days, 12 of which were ultrafiltered. From the 33<sup>rd</sup> day of hospitalization on, she

did not need vasoactive drugs to maintain average blood pressure and on the 38<sup>th</sup> day of hospitalization she stopped being anuric, with the removal of the Shiley catheter on the 45<sup>th</sup> day of hospitalization.

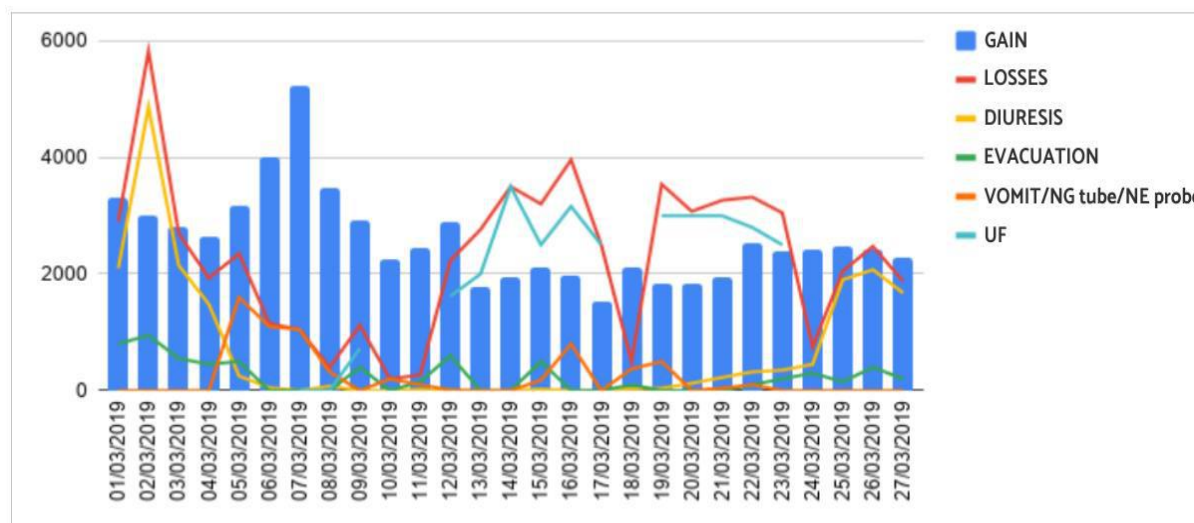


Fig.2: Water balance measured in ml from the patient's gains and losses in the last 24 hours. UF (Ultrafiltrate). ICU / HRC Cacao / RO, 2019.

Source: (ICU, HRC \ SESAU, 2019)

#### IV. DISCUSSION

The actions of botulinum neurotoxins consist of acting on motor neurons, blocking their transmission. As a result, symmetrical flaccid paralysis occurs from the cranial nerves (Rosen et al., 2015). The paralysis caused by botulism is long, extending for weeks to months. The patient depends on diligent and high quality intensive care, ensuring continuous monitoring and ventilatory support (O'Horo et al., 2017).

In a study by Rao *et al.*, (2017) refers to a high level of botulism cases that showed diarrhea and vomit symptoms. Based on that study it is possible to know that the food poisoning caused by *Clostridium* will provoke those symptoms in acute level, expressing clinically through excessive loss of water and electrolytes from those eliminations (Health Ministry BRAZIL, 2012).

That excessive loss of liquid without the right reposition provokes hypovolemia, which will activate the release of the antidiuretic hormone and aldosterone. Thus a decrease in urinary output and changes in the internal balance of water and sodium (Pereset *et al.*, 2010). This hydroelectrolytic disorder is also related to negative outcomes such as long periods of hospitalization and the need to stay in the ICU, with high mortality rates (Rocha, 2011).

The high risk factors for Acute Renal Failure in the ICU include: ischemic, nephrotoxic, infectious, obstructive events, hypotension, shock (hypovolemic, cardiogenic, septic), cardiovascular, hepatic and respiratory insufficiencies, neoplasms and mean hospital stay longer than 7 days. Among which sepsis is the main etiological factor, followed by drug nephrotoxicity (Iodine Contrast), postoperatively due to Systemic Inflammatory Response Syndrome (SIRS) and / or renal hypo perfusion (C.M.S. da Silva *et al.*, Romano, 2015).

According to the magazine Hospitals Brazil-BR (ILAS, 2016), 55% of the patients under sepsis in the ICU die in Brazil. In order to reduce these data it is necessary to grant security protocols of the patient and quality in the offered service.

During septic shock, the use of vasopressors is essential for blood pressure control. The most widely used is Norepinephrine Hermitartarate, as a sympathomimetic agent, it has fast action, acting on cardiac inotropism, peripheral vasoconstriction and, consequently, blood pressure recovery (Pacori & Duque, 2018). The high dose established by the manufacturer can reach 68 mg of norepinephrine daily, varying according to the patient's response. However, high concentration and duration of therapy can lead to tissue hypoxemia and ischemic injury (D. Castro, 2018). It is essential to know the risks this drug

can present, even if, at caveat moments there is the necessity to use sufficiently high doses (Pacori & Duque., 2018)

Considering that sepsis is a fatal disease it is pertinent that the characteristic signs and symptoms be identified by the nursery team. From measuring and trustworthy notes of the urinary output and hydric balance (HB), which can contribute on detecting the renal dysfunction of the septic patient (Viana et al., 2017).

The ARF diagnostic is frequently late and uncertain, which usually delay the beginning of the therapeutic measures. When the ARF is identified the joint hemodynamic management with pressure control and use of VaDis of fundamental importance (Romano, 2015).

Studies have shown hypotension as the most frequent complication within dialysis sessions, where hemodynamic instability is characterized as one of the main intradialytic complications. This requires the nurse to establish specific and systematic care in addition to those exercised in the routine (A. F. S. Silva et al., 2018).

The decision to start Renal Replacement Therapy (RRT) in patients who developed ARF in the ICU is still a matter of doubt for nephrologists and intensivists (Romano, 2015). Nursing's contribution consists of keeping this patient with ARF metabolically stable, having a holistic view of preventing possible complications that arise from dialysis sessions, which are often serious or fatal (C. M. S. da Silva et al., 2016).

To use the diagnostic and systematization of the nursery assistance is a singular foundation to facilitate the decision making and direct the interventions when facing the identified problems (C. M. S. da Silva et al., 2016). The nurse has the responsibility to manage his team, in a manner so that the given assistance be individualized, granting the quality of attendance and minimizing damages, based in the scientific knowledge practice.

## V. CONCLUSION

In reflection we can observe three possible clinical conditions that could take the patient to a condition of hemodynamic instability and ARF as consequence, being them the dehydration due to hydric loss, the sepsis condition and the long period of hospitalization.

Such conclusions were based on the daily nursery notes as well as daily laboratory results inside ICU, to which was possible to evidence the pathophysiological changes that progressively happened and aggravated the clinic condition. It is worth to highlight that although such

complications happened through a short period of time, they could have had a different closure.

Since monitoring and supervising the notes and care taken by the technicians is among other nurse duties, which implies closing and evaluating the day and night "Hydric Balance". The nursery actions when done from systematization, serve as guideline for identifying signs and symptoms that indicate complication over the hospitalization in a Intensive Care Unit. That is why the need for constant scientific technical improvement, in order to improve the future perspective acting on a preventive point of view.

Thereby it is worth to consider that there is a lack of publications emphasizing the nursery care before the patient stricken by food botulism in the country. This report aims to highlight the need for the health team to show competence to provide the survival of these patients that depend on the intensive care, in order to revert the complications reflecting the hospitalization.

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