**ORIGINAL ARTICLE**

# ANALYSIS OF RECORDS REFERRED TO THE WATER BALANCE IN INTENSIVE CARE UNIT
## ANÁLISE DOS REGISTROS REFERENTES AO BALANÇO HÍDRICO EM UNIDADE DE TERAPIA INTENSIVA
## ANÁLISIS DE LOS REGISTROS RELACIONADOS CON EL EQUILIBRIO DEL AGUA EN LA UNIDAD DE CUIDADOS INTENSIVOS

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**ABSTRACT**

*Objective:* evaluating water balance records of critical patients. *Method:* a descriptive, cross-sectional study conducted from January 2012 to March 2013, and held at the Medical Records Service of patients of a university hospital in southern Brazil. Data were analyzed through descriptive statistics using the Statistical Package for Social Sciences (SPSS). There was performed chi-square test of Person, with significance level of 5%. There were analyzed 70 periods of 24 hours (13 patients). The research had the project approved by the Research Ethics Committee, Protocol n°. 106-2012. *Results:* there was found lack of information on the volumes of drainage by various devices. The presence of more than one drainage system was associated with incorrect specification of the volumes (p<0,001). *Conclusion:* water balance (BH) qualification is associated with improvement of records. *Descriptors:* Water Balance; Water-Electrolyte Balance; Nursing; Intensive Care Units; Nursing Records.

**RESUMO**

*Objetivo:* avaliar registros de balanço hídrico de pacientes críticos. *Método:* estudo descritivo, transversal, realizado de janeiro de 2012 a março de 2013 realizado no Serviço de Prontuários dos Pacientes de um Hospital Universitário do Sul do Brasil. Os dados foram analisados por meio de estatística descritiva com uso do programa Statistical Package for the Social Sciences (SPSS). Foi realizado teste qui-quadrado de Person, com nível de significância de 5%. Analisou-se 70 períodos de 24 horas (13 pacientes). A pesquisa teve aprovado o projeto pelo Comitê de Ética em Pesquisa, Protocolo n°. 106-2012. *Resultados:* encontrou-se a falta de registro sobre os volumes de drenagens pelos mais variados dispositivos. A presença de mais de um sistema de drenagem esteve associada a não especificação correta dos volumes (p<0,001). *Conclusão:* a qualificação do BH está associada ao aprimoramento dos registros. *Descritores:* Balanço Hídrico; Equilíbrio Hidroeletrolítico; Enfermagem; Unidades de Terapia Intensiva; Registros de Enfermagem.

**RESUMEN**

*Objetivo:* evaluar los registros de balance hídrico de los pacientes críticos. *Método:* un estudio descriptivo, transversal realizado a partir de enero 2012 hasta marzo 2013; se celebró en los registros de servicio médico de los pacientes de un hospital universitario en el sur de Brasil. Los datos se analizaron mediante estadística descriptiva utilizando el paquete estadístico para Ciencias Sociales (SPSS). Se realizó la prueba de chi-cuadrado de Person, con un nivel de significación de 5%. Se analizaron 70 períodos de 24 horas (13 pacientes). La investigación tuvo el proyecto aprobado por el Comité de Ética en la Investigación, Protocolo n°. 106-2012. *Resultados:* se encontró la falta de información sobre los volúmenes de drenaje por varios dispositivos. La presencia de más de un sistema de drenaje se asoció con especificación incorrecta de los volúmenes (p<0,001). *Conclusión:* la calificación del balance hídrico (BH) se asocia con una mejoría de los registros. *Descriptores:* Balance Hídrico; Equilibrio Hidroelectrolítico; Enfermería; Unidades de Cuidados Intensivos; Registros de Enfermería.

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## INTRODUCTION

The compromise with nursing care is not only associated to customer's satisfaction. The quality of the record of care activities reflects the quality of care and labor productivity. Based on the assessment records, it can be permanently build better care practices and improvements in operating results.[1]

The records in the patient's medical records are data and actions vouchers during its stay and the audit of these have application to the compliance information based on institutional standards and ethical and legal principles.[2] The electrolyte balance is a dynamic physiological process, vital and crucial for hemostasis.[3] The data required to evaluate this balance include measurement and the total registration given fluid and phased out over a period of 24 hours. The registration of the water balance is a routine in the care of unstable patients. The nurse need not and should not wait for a prescription to get control of administered fluids and lost.[4]

Healthy individuals maintain total body water in a remarkably constant value. This steady state is achieved by an even balance between supply of liquid and debt - urine output and not renal insensible losses of water. The main causes of volume depletion may be due to renal losses (hormonal deficit, renal deficits) or extra-renal (bleeding, skin loss - sweating and burns, gastrointestinal losses - vomiting, diarrhea disorders, gastrointestinal fistulas, drainage by probes).[5]

Electrolyte disturbances are among the most common clinical problems in intensive care unit and are associated with increased morbidity and mortality among critically ill patients.[6] Although many diseases found in ICU may be responsible for the development of electrolyte disturbances, drug therapy can also contribute to these disorders.[7]

The analysis and clinical research of electrolyte disturbances include the assessment of blood pressure, pulse, respiration, edema, skin turgor, the diuresis, the need for intravenous infusion of drugs that alter the water/electrolyte balance and also observing the prescription as to the frequency of controls and/or care for the intake and elimination, hourly, shift and every 24 hours.[8] Short-term weight changes, usually indicate changes in water state. Each kilogram of body weight is equivalent to 1 liter of liquid.[9]

The losses of a typical water balance of 24 hours are: 1500 ml in the urine, feces 200ml, 100-200 by sweating; 300-400 ml heat loss through the skin and 300 ml through breathing.[10]

The scarcity of original descriptive data published in Brazil and abroad as the water balance - evaluation widely used in intensively therapy and especially on the associated records, is consistent motivation for conducting research on the subject, since nurses are professionals directly involved in therapy, we in the quality of records and completion of the water balance calculation. Research on this subject allow the improvement of this care and also the redirection of practices that hinder the calculation, the water balance analysis and the assistance provided based on the results. Given the above this study aims to:

♦ Assessing water balance records of critical patients.

## METHODOLOGY

This is a quantitative, retrospective, cross-sectional study, of analysis of medical records. Cross-sectional studies involve the collection of data at a given time point at which all phenomena studied are covered for a period of data collection.[11] We tried to organize data in order to obtain relevant information about the nursing records that support the water balance calculation. The survey was conducted in the Medical Records Service of Patients of a University Hospital located in southern Brazil.

The University Hospital has 189 beds SUS. The general Intensive Care Unit (ICU), where there were made the records of interest, has six beds. The nursing team consists of 25 professionals, including nurses, technicians and assistants, responsible for records made.

From January to March, there was conducted an observational survey-finding devices that assist the nursing staff in the control of water balance. The study sample comprises the universe of records made by care of critically ill patients in the general ICU. It was considered as the sample inclusion criteria records for the water balance of patients admitted to the general ICU of the University Hospital with length of stay in the ICU for at least a full 24-hour period for the calculation of BH. For patients with prolonged hospitalization, we considered only the first seven full periods for water balance log analysis in 24 hours. Each period consists of three work shifts (7:00 a.m.-13:00, 13:00-19:00, and 24:00-07:00).

The BH records were analyzed in 70 periods totaling analysis of 1680 hours of nursing care, relating to 13 patients who were admitted to the general ICU between January and March

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2012; the sample were excluded 12 patients - nine because not completed a full term in the ICU and three because their records were in audit during the data collection period.

Variables were investigated that include patient weight, liquid administrations of oral and parenteral route, net of eliminations the - vomiting, feces, urine, drainage (for probes, drains, stomas), ultrafiltration volumes due to hemodialysis. These variables are recorded in the control sheet of vital signs of patients.

We assessed conditions relating to food - use of nasogastric tube (NGT), nasogastric tube (NGT), total parenteral nutrition (TPN), gastrostomy, jejunostomy and NPO (nothing by mouth). Regarding systems and drainage collectors, we evaluated the presence of urinary catheter, diapers, drain, of chest, of Kher, of sump, colostomy, ileostomy, Penrose, Karaya bag (for draining reception wound cavity), open nasogastric tube in bottle (SNG A/F) and open nasoenteric probe in bottle (SNE A/F).

There was also analyzed the use of mechanical ventilation, occurrence of fever, the presence of vital signs erasures control sheet and there is also mention that record the results of BH 24 hour nursing changes in the analyzed time periods. There were identified gender, age, length of stay in the ICU that were prevalent for the profile of patients' knowledge. The description of the drainage volume was evaluated and found to correct if there was presence of records specifying volume in the three work shifts (full period of the BH analysis).

Data were coded and entered into a database using Microsoft Excel and analyzed with the Statistical Package for Social Sciences (SPSS), using descriptive statistics, by calculating the mean, absolute frequency, relative and percentage. Qualitative variables were compared using the chi-square, and were considered statistically significant results those with $p < 0.05$.

The project was approved by the Research Ethics Committee of the institution, following the opinion paragraph 106-2012. The authors signed Statement of Commitment to Data Use to access the records.

## RESULTS

In general ICU, it calculates the BH of all hospitalized patients. For this, it has graduated bottles for measurement of drainage volumes. During the review period there was available for use of the nursing team system for weighing patients. The water balance is calculated by the formula given BH = liquid - liquid disposed - (10 x weight of the patient) and the patient's weight is estimated. There are scales for baby differential weighing, beds or dressing clothes. There is also a standardization of drug dilutions, there is a standardized checklist for compliance between prescriptions x standardization dilution medicines x records made by the nursing staff. There is no standardization in relation to the description of the volume of feces, in small, large, medium amount or if the system of crosses.

Of the 13 patients, seven (53,8%) were female, the average age was 55,5 years old. The mean length of ICU stay was 15 days. The most prevalent diseases were respiratory tract infection in 61,5% of patients, sepsis in 53,8% and Acquired Immune Deficiency Syndrome in 23,1%. All study patients died. Ten (76,9%) had the same estimated weight from start to finish of the ICU stay.

With regard to the food and food systems, the results are shown in Figure 1.

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Figure 1. Percentages pertaining to the type of feed/food systems in patients who were admitted to the ICU between the periods of January to March 2012.

In 58 (82,9%) of the 70 periods analyzed, the patients were on mechanical ventilation and the percentages regarding the presence of drains/ systems drainage collectors, can be found in Figure 2.
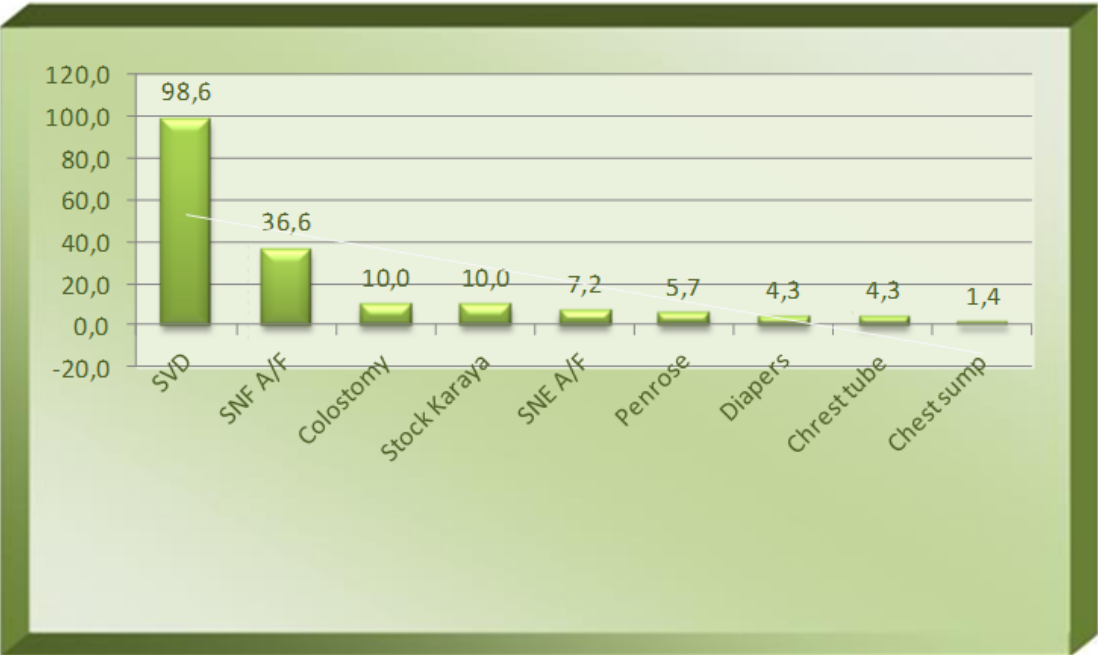


Figure 2. Percentages pertaining to types of drains in patients who were admitted to the ICU between the period of January to March 2012.

The non-conformities (not description of drainage volumes in one or more work shifts) in the description of the volumes of the drainage devices are represented in Figure 3.



Figure 3. Percentages of incorrect descriptions in relation to the volumes of the respective drainage devices in patients who were admitted to the ICU from January to March 2012.

Nursing technicians recorded the volume of diuresis by SVD in 100% of the periods when patients were using this device, however, these are not routinely describe the appearance of diuresis. It was observed that there is a concern about the nurses aspect of description, but this data is not included in all nursing upgrades.

In this study, on 34 times is found only the presence of a drainage system; 22 periods, two drainage systems; 10 times, three drainage systems; and in 4 periods, 4 drainage systems.

The correct description of drainage volumes from the group had only a drainage system and the group had more than one system was analyzed. The first group was 94,1% (32/34) of correct descriptions, while in the second, only 27,8% (10/36). It was observed that estisticamente significant

difference (p<0,001) between the groups, which means the presence of more than a drainage system was associated with incorrect specification the volumes.

One patient was submitted on 3 study periods to thoracentesis, drains 300, 500 and 800 ml. And only the drain 300 ml was recorded in the control sheet of vital signs and accounted for water balance calculation. Another patient had extensive Fournier gangrene and in the nursing evolutions there was reported abundant blood secretion, even by thorough washing of the lesion; however, the drainage volume was not specified or estimated and it was not counted in the calculation water balance.

Only one patient had a single episode of vomit and its volume was not specified. In 14 (20%) periods analyzed patients had fever. In 42 (87,5%) of 48 of the periods when patients had bowel movements, there was no specification as to the amount of feces eliminated. Such noncompliance vital signs appeared in control sheet described for example by coach, "feces 1 x". It observed also an underreporting of the description of the occurrence or absence of stools in nursing developments.

Another important factor observed in the analysis was the lack of standardization not only in relation to the volume of feces, but also in the aspect of the specification. Importantly, this review refers to the elimination of stool anal route since the evaluation of feces by colostomy was evaluated separately as drainage system.

In 4 of the 7 periods (57,1%) in which patients underwent hemodialysis with ultrafiltration rate, the volume was not specified in the control sheet of vital signs. In 48 (68,6%) periods were found in control leaves erasures vital signs.

In only 22 (31,4%) of the 70 periods analyzed, nursing developments were found to quote the result of the BH 24 hours. Considering the records made in vital signs control sheet and reproducing the ICU routine calculation for BH, mathematical error was found in 46 (65,7%) of the 70 periods analyzed.

## DISCUSSION

The general ICU nursing team has at its disposal graduates containers for measurement of drainage volumes. Such availability and use are essential for the calculation of BH and therefore for better monitoring of fluid and electrolyte status of the patient. It is noteworthy that for the BH control there are needed graduated containers to measure specific amounts, as estimated volumes are considered inaccurate. In accurate assessment the nurse weighs the wet linens, bandages, diapers, liners and pads, and subtract the weight of a dry similar item.[12]

But still, there is no available weighing scales differential dressings, clothes, or even to the patient weighing between ICU material resources in which the study was conducted. Take place estimates of weights, condition not indicated in the literature.

Regarding the formula for calculation of water balance (BH), there was not met the indication of a formula that standardizes heat loss. Only, it is recommended to BH calculation discount of all administered liquids, deleted.[3-5] However, as heat loss range 500-1000 ml in adult patients;[10] can be said that the estimated heat loss used in the study ICU (weight x 10), is in agreement with the literature.

The lack of standardization of dilutions and the lack of a check list to assess the compliance of medical prescriptions with the recordings affected the analysis of records administered orally and intravenously.

The nursing team must start the gains and losses of control when there is potential risk to the water imbalance in critically ill patients. And this control plus the patient diary weight is essential for nutritional assessment and water balance. The use of materials such as chalices and graduated pitchers and recording methods, facilitate this control and provide data showing the effectiveness of diuretic therapy or rehydration.[8]

Ten patients (76,9%) had the same estimated weight from start to finish of ICU stay, and, in 2004, the authors Potter and Perry, consider that for the control of fluid and electrolyte balance is required the daily weighing of the patient beyond to measure the liquid administered and disposed.[4] The daily record of managed volumes and eliminated is a less accurate method that daily weighing, when you want to monitor the water balance. It is essential that management and disposal of liquid are effectively measures and not only estimated. It is noteworthy that patients requiring intensive care often have significant weight changes - such as edema and loss of muscle mass, so consider the same weight from start to finish ICU admission makes the monitoring of inaccurate BH.

Mechanical ventilation was found in 82,9% of the analyzed periods, which may be associated with greater losses insensitive

through the lungs. It is believed that eliminating the lungs 350 - 400 ml of fluid/day through breathing and it is considered insensitive to water loss in exhaled breath.[9]

The lack of information on the volumes of drainage for all kinds of devices is a reality in nursing care. Not consider the volumes drained by thoracentesis, paracentesis, external ventricular drainage, wounds and hemodialysis compromise the reliability of the monitoring of water status of the patient. The insensible water loss - perspiration - represents 350 to 400 ml/day and increases in cases of open wounds, burns or by damage of the skin integrity.[9]

In 4 of 7 periods (57,1%) patients that underwent dialysis to ultrafiltration rate, the volume was not specified in the control sheet vital signs. The absence of such notification generates an error in the statement of BH that can compromise the treatments.

Using SVD in ICU is, practically, a routine in nursing practice; and perhaps therefore be more widely recognized, widespread and notified. Urine is the largest amount of fluid loss, approximately 1500 ml/day, 30 to 50 ml/hour depending on the fluid intake and other losses (vomiting, excessive perspiration, for example).[9]

In 42 (87,5%) of 48 of the periods when patients had bowel movements, there was no specification as to the amount of feces eliminated. Such noncompliance vital signs appeared in control sheet described for example by coach, "feces 1 x". It observed also an underreporting of the description of the occurrence or absence of stools in nursing developments. Another important factor observed in the analysis was the lack of standardization not only in relation to the volume of feces, but also in the aspect of the specification. It is estimated that the feces are responsible for losses of the order of 100 to 200ml/day. Their frequency and consistency interfere with the volume of lost fluids.[9]

The quality and accuracy of nursing records are critical to the correlation of these records with the test results, and especially with the clinic presented by patients and also aimed continuity of care and better clinical assistance.

Underreporting of income for the BH developments in nursing (31,4%) shows a lack of correlation between the practice of performing the calculation and its correlation with clinical signs. Descriptive, qualitative study, performed in a hospital in Fortaleza-CE, found that most nurses have a concept on water balance, even if devoid of complexity

and tries to apply their findings in assistance. Nurses considered important to have tools that help in the measurement of volumes as well as having attention and care in performing this procedure, so that all liquids are measured correctly, favoring the acquisition and registration of reliable figures. However, after completion of the study it was found that nurses consider relevant despite the water balance, the results of this are hardly used to guide nursing care.[13]

In 68,6% of the periods were found deletions in control sheets of vital signs. Another study, document on nursing records made in the fluid balance of patients hospitalized in coronary intensive care unit of a public hospital in Fortaleza-CE, which analyzed 16 medical records, found that all records had records on water balance, however, only 58,3% were complete, 83,3% were readable, 56,2% had no erasures. Regarding the administration of drugs, 45,8% was not on the records of liquids administered orally. The record for the intravenous administration was the most frequent, representing 93,7% of the cases analyzed.[14] These data reinforce the gaps for the water balance, because although such control is a routine practice of nursing, this is permeated with incomplete records and presence of erasures.

The quality of care is associated also to the quality of made records[1] and the presence of erasures may compromise the institution as to the ethical and legal support.[15]

A study that analyzed 144 medical records - through a check-list, drawn up in accordance with the literature and legislation - aimed to identify the quality of nursing records in hospital bills in three units of private health plans in a university hospital of Curitiba. Found major problems: notes made by shift and not by time; presence of erasures in written; blanks over printed; lack of stamp and signature. Identified records when checking prescriptions did not occur or was performed incorrectly; found also incomplete notes vital signs.[16]

Another study evaluated the quality of nursing notes in a university hospital. Analysis of the item "nursing notes" has, at the institution where the study was conducted, 19 indicators as guidelines in the assessment process. In order to facilitate the evaluation, the study used the percentage of ideal positive about the results. Data collection, supported by the quality of evaluation reports on nursing institution, assigned to the item "Nursing Annotation" the complete, incomplete, not filled and incorrect criteria,

for which we adopted as satisfactory: over 80%, below 15% below 5% and 0%, respectively. Unsatisfactory values were found for the quality of nursing records in intensive care units, locations requiring greater scientific knowledge of expenditure and control of the patient's clinical status, which affects the effective communication between team members and the ethical support of the work done by staff.[15]

The study mentioned above concluded that professionals crowded in these units, before their technical skills, have a greater concern for patient observation and implementation of labor demand in the execution of activities of care with the patient, giving the background, the implementation of the records of the provision of nursing care. This is to be assessed in order to enhance the management of the work process in the Intensive Care Unit because the qualified care is directly linked to the records made and the security provided by health care.

Study with a statistical model of longitudinal cohort of patients with heart failure is to describe the non-pharmacological management of these patients, evaluated 283 admissions of 239 patients. Found a prescription pattern of different non-pharmacological measures - salt restriction in 97%, diuresis control in 85%, 75% water balance, weight control in 61%, and fluid restriction in only 25% of admissions.[17]

The study cited above found that although the above were in the care requirements, were often not carried out by the responsible staff. Only 51% of water balance and 66% of prescribed diuresis controls were actually made by the nursing staff. Data indicated that even at a teaching hospital, important gaps exist between prescribing and execution of non-pharmacological measures in the management of patients with heart failure.[15]

The involvement of accurate fluid balance record is associated with the difficulty in accounting for heat loss, it involves several people: nurses, nursing technicians, assistants and doctors, and the lack of uniformity in the measurement and characterization of some clinical findings.[18]

Considering the records made in vital signs control sheet and reproducing the ICU routine calculation for BH, mathematical error was found in 46 (65,7%) of the 70 periods analyzed, this data can be associated with inattention of the professionals who performed the calculation and also not using a computerized system. This could automatically calculate the BH from the administered liquid releases and eliminated in the control sheet of vital signs.

The loss of liquid through the sensitive skin, sweating, is estimated at 300-500ml/day variables such as fever, metabolic activity, physical activity can enhance these losses.[9]

## CONCLUSION

In this study, after investigation of 70 periods of BH, 1680 hours of nursing care, relating to 13 patients, it was found that was available to the graduates utensils nursing staff for drainage volume measurement, however, such availability not meant effective control of eliminations. Drains for Karaya bag, SNE A/F and diapers were not properly recorded in 100% of the periods when patients used these devices, drainage by SNG A/F were incorrectly specified in 77,8% of periods.

The correct description of the drainage volume from the group only had a drainage system with the group that had more than one system was analyzed. The first group was 94,1% (32/34) of correct descriptions, while in the second, only 27,8% (10/36). It was observed that estisticamente significant difference (p<0,001) between the groups, which means the presence of more than a drainage system was associated with a worse specification the volumes.

It was found that SVD was a drainage system widely used in ICU, present in 98,6% of the analyzed periods, and that nursing technicians properly recorded the volume drained in 100% of the periods when patients were using this device. The weight estimate itself is not a method indicated by the literature and the same estimated weight of the patient after the start of the ICU stay, which occurred with 76,9% of patients, breaks with the attempt to data reliability. We suggest the weighing system acquisition for better assessment of electrolyte status of the patient.

In 48 (68,6%) periods were found deletions in control sheets of vital signs, and the records are legal and ethical vouchers of care. Thus, the service quality is directly related to the quality of the records. In only 22 (31,4%) of the 70 periods analyzed, nursing developments were found to quote the result of water balance of 24 hours, and calculating the BH of all ICU patients. This is a routine in care practice that should be associated with the notification and recovery as the importance of these data with the correlation of the clinical status of the patient. Despite the water balance is a nursing practice widely used in the context of intensive care, there is

a big gap in the standardization of records and also with regard to the calculation to be used.

From the data it was concluded that to have a reliable monitoring there must be investment in the acquisition of tools that enable the measurement drained volumes, the acquisition of scales for weighing, in the standardization of records and preparation of checklists to facilitate and optimize the assessment of electrolyte status of the patient. We must invest in continuing education on the subject in order to qualify the care related to fluid balance of patients and ensure the legal guarantee and ethics of records relating to the actions performed during hospitalization, also aiming a better safety for health care.

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