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PREVENTION OF CATHETER-ASSOCIATED URINARY TRACT INFECTION: WHAT IS THE GAP IN CLINICAL PRACTICE?

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ABSTRACT

Objective: to identify the gap in the prevention of catheter-associated urinary tract infection.

Method: an observational study conducted by an audit of process indicators in relation to the recommendations for preventing catheter-associated urinary tract infection during its maintenance and handling. The collection was carried out between July and September of 2017 in an adult intensive care unit located in the State of Minas Gerais, Brazil. The observations were made with the help of a developed instrument for the present study and the data were analyzed by means of descriptive statistics.

Results: 451 evaluations were performed related to maintenance of the urinary catheter with a focus on its fixation, the collector bag maintenance, and volume and urinary flow of the drainage system. Regarding clinical practice gaps, inadequate fixation of the urinary catheter and drainage pocket were found, with more than three-quarters of its capacity filled (97.7% and 3.5%, respectively). Regarding the handling of 556 urinary catheters, there was non-conformity in the hygiene of the urethral meatus in 22.9% of the situations, and non-adherence to hands hygiene before and after handling the urinary catheter was 94.2% and 66.5%, respectively ($p=0.002$).

Conclusion: isolated measures had good adherence rates, but prevention of catheter-associated urinary tract infection should be based on adherence to several measures simultaneously. The prevention gap is in the awareness of health professionals that the recognized prevention measures of catheter – associated urinary tract infection should be adopted collectively in order to guarantee patient and clinical practice safety.

DESCRIPTORS: Urinary catheters. Catheter-related infections. Infection control. Delivery of health care. Patient safety.

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PREVENÇÃO DE INFECÇÃO DO TRATO URINÁRIO ASSOCIADA A CATETER: QUAL O GAP NA PRÁTICA CLÍNICA?

RESUMO

Objetivo: identificar o *gap* para prevenção de infecção do trato urinário associada ao uso do cateter vesical.

Método: estudo observacional conduzido por auditoria de indicadores de processo em relação às recomendações para prevenção da infecção do trato urinário associada ao uso de cateter vesical durante sua manutenção e manipulação. A coleta foi realizada entre julho e setembro de 2017, em uma unidade terapia intensiva adulto, localizada no Estado de Minas Gerais, Brasil. As observações foram realizadas com auxílio de um instrumento desenvolvido para o presente estudo e os dados foram analisados por meio de estatística descritiva.

Resultados: foram realizadas 451 avaliações relacionadas à manutenção do cateter vesical com foco em sua fixação, manutenção da bolsa coletora e volume e fluxo urinário do sistema de drenagem. Como lacunas da prática clínica, foram verificadas fixação inadequada do cateter vesical e bolsa coletora de drenagem com mais de três quartos de sua capacidade preenchida (97,7% e 3,5%, respectivamente). No tocante à manipulação, de 556 cateteres vesicais, houve inconformidade na higiene do meato uretral em 22,9% das situações, e a não adesão à higienização das mãos antes e após o manuseio do cateter vesical foi de 94,2% e 66,5%, respectivamente ($p=0,002$).

Conclusão: medidas isoladas apresentaram boas taxas de adesão, mas a prevenção da infecção do trato urinário associada ao uso do cateter vesical deve se basear na adesão a várias medidas de forma simultânea. O *gap* para prevenção está na conscientização dos profissionais de saúde de que as medidas reconhecidas para prevenção da infecção do trato urinário associada ao uso do cateter vesical devem ser adotadas de forma coletiva, visando garantir a segurança do paciente e da prática clínica.

DESCRIPTORIOS: Cateteres urinários. Infecções relacionadas a cateter. Controle de infecções. Assistência à saúde. Segurança do paciente.

PREVENCIÓN DE INFECCIÓN DEL TRATO URINARIO ASOCIADA A CATETER: ¿QUÉ GAP EN LA PRÁCTICA CLÍNICA?

RESUMEN

Objetivo: identificar el *gap* para prevención de infección del tracto urinario asociado al uso del catéter vesical.

Métodos: estudio observacional conducido por auditoría de indicadores de proceso en relación a las recomendaciones para prevención de la infección del tracto urinario asociada al uso de catéter vesical durante su mantenimiento y manipulación. La recolección se realizó entre julio y septiembre de 2017, en una unidad de cuidados intensivos adultos, en el Estado de Minas Gerais, Brasil. Las observaciones fueron realizadas con ayuda de un instrumento desarrollado para el presente estudio y los datos fueron analizados por medio de estadística descriptiva.

Resultados: se realizaron 451 evaluaciones relacionadas con el mantenimiento del catéter vesical con foco en su fijación, mantenimiento de la bolsa colectora, y volumen y flujo urinario del sistema de drenaje. Como lagunas de la práctica clínica, se verificó la fijación inadecuada del catéter vesical y bolsa colectora de drenaje con más de tres cuartos de su capacidad llenada (97,7% y 3,5%, respectivamente). En cuanto a la manipulación, de 556 cateteres vesicales, hubo inconformidad en la higiene del meato uretral en el 22,9% de las situaciones, y la no adhesión a la higienización de las manos antes y después del manejo del catéter vesical fue del 94,2% y 66,5%, respectivamente ($p=0,002$).

Conclusión: medidas aisladas presentaron buenas tasas de adhesión, pero la prevención de la infección del tracto urinario asociada al uso del catéter vesical debe basarse en la adhesión a varias medidas de forma simultánea. El *gap* para prevención está en la concientización de los profesionales de salud de que las medidas reconocidas para prevenir la infección del tracto urinario asociada al uso del catéter vesical deben ser adoptadas de forma colectiva, para garantizar la seguridad del paciente y de la práctica clínica.

DESCRIPTORIOS: Cateteres urinarios. Infecciones relacionadas con el catéter. Control de infecciones. Prestación de atención de salud. Seguridad del paciente.

INTRODUCTION

Healthcare-associated infections (HAIs) are seen as an aggravation of broad epidemiological significance within the context of hospital care, and as the fourth cause of complication in developed countries, mainly due to the use of invasive devices.¹ Among them, catheter-associated urinary tract infections (CAUTI) account for about 40% of HAIs, and its development is directly related to the usage duration of this device. The main consequences of CAUTI are bacterial resistance, morbidity and mortality, and increased costs of health care.²⁻³

It is estimated that up to 69% of CAUTIs are avoidable, provided that prevention and control strategies are implemented. As prevention measures, in addition to their proper use and aseptic technique for urinary catheter insertion, quality improvement programs should be implemented with an active approach through process audits to evaluate team adherence to aspects related to appropriate practices for maintenance and handling of the urinary catheter. For the maintenance, these practices include care in fixation of the urinary catheter; the bag collector having less than three-quarters of its capacity filled, being below bladder level and not having contact with the ground; unobstructed urinary flow and use of a closed drainage system. In handling, five moments for hand hygiene (before and after contact with the patient, before the aseptic procedure, after exposure to body fluids and after contact with areas close to the patient) can be mentioned, and standard precautions.³⁻⁶

Reducing IRAS through evidence-based recommendations has become an increasing priority, both for patient safety and for reducing health costs.⁷

In concern for healthcare quality, the Institute for Healthcare Improvement proposed a set of actions (a bundle), which potentiate significantly better results when implemented simultaneously compared to when measures are adopted individually, even if their effectiveness is scientifically proven.³⁻⁴

However, any improvement strategy should be evaluated for its expected impact in clinical practice. The availability of outcome indicators through reports and analysis of surveillance data often does not allow for understanding the reality of HAI occurrence to enable planning and measures aimed at effective prevention. Thus, the existence of a protocol and/or the isolated use of outcome indicators is not a guarantee of qualified clinical practice.^{4-5,7-8} Identifying the clinical practice gaps associated with urinary catheter handling and maintenance techniques for CAUTI prevention is fundamental and enables targeted interventions to support safe patient care.

This study aimed to identify the gap in the prevention of catheter-associated urinary tract infection.

METHOD

An observational study performed at the intensive care unit (ICU) for adult patients containing ten beds in a highly complex hospital in the State of Minas Gerais, with 80% of the services performed by the Unified Health System (*SUS* – Sistema Único de Saúde).

Data collection was performed by convenience sampling from July to September 2017, uninterrupted by two nursing students in Scientific Initiation, duly trained through studies and discussion of evidence-based practices for CAUTI prevention. Direct observation of professionals' adherence to the CAUTI prevention measures during the maintenance and handling of the urinary catheter occurred in a way that the professionals did not associate the presence of the observer with the motives for the observation in seeking to soften the Hawthorne effect. For this, a strategy of presenting observers being present in the unit was adopted for other justifications, which had no direct relation with their real intention. The academics positioned themselves in the vicinity of the patient beds who had urinary catheters and thus observed the professionals' adherence to the CAUTI prevention measures. A pilot

study was conducted in May 2017 in a unit similar to the research site, following the same design in order to evaluate the instrument, its replicability and standardization in the collection.

The observations were carried out using a specifically prepared structured script for the present study containing recommendations for CAUTI prevention during maintenance and handling of the urinary catheter, and were performed during the daytime (at 7:00 to 19:00) and at night (from 19:00 to 7:00). The instrument was developed based on evidence-based practices for CAUTI prevention recommended by the Guidelines for Prevention of Catheter-Associated Urinary Tract Infections;³ *Strategies to Prevent Catheter-Associated Urinary Tract Infections in Acute Care Hospitals: 2014*⁴ and Measures to Prevent Urinary Tract Infection, from the National Health Surveillance Agency.⁹ It should be noted that the instrument was not validated.

The instrument included six process indicators related to maintenance and another six to process handling (Box 1).

Box 1 – Description of the process indicators evaluated during maintenance and handling of the urinary catheter in the intensive care unit. Montes Claros, MG, Brazil, 2017.

Maintenance indicators	Correct catheter fixation (in the hypogastric region in males, and inner thigh, female)	Handling indicators	Professional category that performed the handling
	Holding bag below bladder level		Type of handling (bathing in bed, emptying the collector bag and handling the urinary catheter)
	Volume of urine in the collector bag, being below three-quarters of its capacity in order to prevent backflow		Hygiene of the hands before and after handling the urinary catheter (taking into account the five moments for hand hygiene: before and after contact with the patient, before the aseptic procedure, after risk of exposure to body fluids and after contact with the areas close to the patient) ⁶
	Unobstructed urinary flow		Using procedure gloves while handling the urinary catheter
	Closed drainage system		Hygiene of the urethral meatus during bathing
	Suspended collector bag not having contact with the floor		Use of individual container for emptying the collector bag

Source: Gould et al.³

The handling types were divided into three groups: bathing in bed, emptying the collector bag and handling the urinary catheter, which is characterized as any other care in which the professionals' hands touched the catheter.

Descriptive data analysis was performed as well as the Pearson chi-square test or Fisher's exact test in the Statistical Package for Social Sciences (SPSS®), version 23.0. The research complied with all recommendations of resolution 466/2012 of the National Health Council.

RESULTS

A total of 57 daily observations were performed, 31 in the day shift and 26 at night, totaling 376 hours and 451 evaluations of the urinary catheterization maintenance. The audit results of the process indicators for maintenance of the urinary catheter in the ICU are presented in Table 1.

Table 1 – Audit of measures for urinary tract infection prevention during maintenance of the delayed urinary catheter in the intensive care unit according to process indicators (n=451). Montes Claros, MG, Brazil, 2017

Indicators	n (%)
Adequate fixation of urinary catheter	
Yes	6 (1.3)
No	256 (56.8)
Not observed	189 (41.9)
Closed drainage system	
Yes	451 (100)
No	0
Unobstructed urine flow	
Yes	441 (97.8)
No	10 (2.2)
Collector bag below bladder level	
Yes	448 (99.3)
No	3 (0.7)
Suspended collector bag not having contact with the floor	
Yes	449 (99.6)
No	2 (0.4)
Collector bag with less than three-quarters of its capacity filled	
Yes	435 (96.5)
No	16 (3.5)

It was only possible to observe fixation of the urinary catheter in 262 maintenance evaluations, with a non-compliance rate of 97.7%. Fixation was not performed in most of the observations (76.0%), and when present (21.7%) it was done incorrectly (on the bed and the external part of the patient's thigh). There was no difference in the behavior of the professionals considering day and night shifts in the maintenance care of the urinary catheter, except in the care of the collector bag with less than three-fourths of its filled capacity, since this non-conformity was most observed during the night shift (81.3%, $p=0.008$).

The results of the professionals' adherence to the CAUTI prevention measures during handling the urinary catheter refer to 556 procedures. Bathing in the bed represented 39.3% of the handling; direct handling of the urinary catheter, 32.5%; and emptying the collector bag accounted for 28.2% of the handling (Table 2). The professionals who performed the greatest amount of handling were nursing technicians (98.4%), followed by the doctors (0.9%) and nurses (0.7%).

Table 2 – Professionals' adherence to measures to prevent urinary tract infection during handling the urinary catheter in the intensive care unit, according to the handling type (n=556). Montes Claros, MG, Brazil, 2017

Handling type	Yes n (%)	No n (%)
Patient bathing		
Hand hygiene before handling	15 (6.9)	203 (93.1)
Use of procedure gloves during handling	210 (96.3)	8 (3.7)
Hygiene of the urethral meatus	168 (77.1)	50 (22.9)
Hand hygiene after handling	67 (30.7)	151 (69.3)
Handling the urinary catheter		
Hand hygiene before handling	8 (4.4)	173 (95.6)
Use of procedure gloves during handling	151 (86.4)	30 (16.6)
Hand hygiene after handling	60 (33.1)	121 (66.9)
Emptying the collector bag		
Hand hygiene before handling	9 (5.7)	148 (94.3)
Use of procedure gloves during handling	155 (98.7)	2 (1.3)
Emptying in individual container	156 (99.4)	1 (0.6)
Hand hygiene after handling	59 (37.6)	98 (62.4)

The overall adherence rate to the use of procedure gloves was 92.1% and hand hygiene before and after urinary catheter handling was 5.8% and 33.5%, respectively ($p=0.002$). Before handling the urinary catheter, simple hand hygiene was performed in 100% of the sample, and after in 96.2%; antiseptic friction was done in 2.7%; and simple hygiene followed by antiseptic friction in 1.1% of the handlings. Figure 1 shows adherence to hand hygiene before and after each type of urinary catheter handling in the ICU for 376 hours of observation.

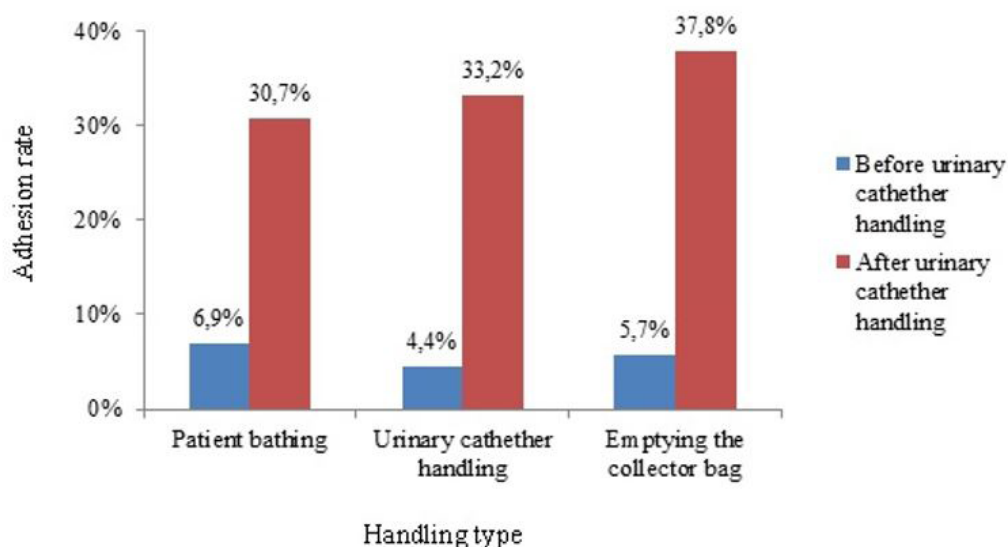


Figure 1 - Adhesion to hand hygiene before and after handling the urinary catheter according to the handling type. Montes Claros, MG, Brazil, 2017

DISCUSSION

Even though CAUTI it is considered an avoidable adverse event, it still represents a challenge for the quality of healthcare.⁷ Data from the Centers for Disease Control and Prevention point to an increase in the CAUTI rate of 3% over the 2009-2012 period, and of 6% from 2009-2013.¹⁰ In the surveyed unit, the incidence density of CAUTI was 4.8 per 1,000 catheters/day in 2017, meaning a higher rate than that of international studies.¹¹⁻¹²

In the evaluation of the maintenance conditions and handling of the urinary catheter in this investigation, adherence was observed in isolated prevention measures, compromising the quality of provided care. This fact leads us to believe that there is still difficulty for health professionals in understanding multiple measures simultaneously, evidencing an important gap to be filled by means of training, discussing cases and conducting audits in the units, especially in those with greater use of invasive devices and more critical patients.^{4,7}

Non-conformities to the process indicators in the maintenance and handling of the urinary catheter were identified and present risk conditions for patient safety. Although the majority of items reached close to 100% adequacy indices, general compliance was impaired due to the low adherence of the team to adequate catheter fixation, hand hygiene before and after handling, and hygiene of the urethral meatus during which there are potential actions that favor CAUTI occurrence.

On the other hand, it is important to note that the closed urinary drainage system is a structure item related to the type of material offered by the hospital to perform the procedure. However, it is not able to prevent CAUTI in isolation if: (1) it is not fixed correctly; (2) its fill level is above recommended; and (3) the handling is not appropriate - to mention some aspects that are intended for prevention.^{3-4,9}

Incorporating and recognizing the importance of other measures to prevent CAUTI in an individual and collective way through training is essential, since only making adequate materials available is insufficient if they are not used correctly.

Urinary catheter fixation was the indicator component with the lowest adequacy index. The great risk associated with inadequate fixation is directly related to the possibility of urinary catheter traction, which can cause lesions in the urethra and bladder neck during bed mobilization, as well as the migration of potentially infectious agents, considerably increasing the CAUTI risk.⁹ This non-compliance was also observed in other studies, ranging from 72.0 to 92.0%.¹³⁻¹⁴ Although it is a simple action and there is high scientific evidence to prevent urinary reflux and bladder contamination which favor CAUTI occurrence, its frequency is not only high in the present study, but in several others, reinforcing that adequate urinary catheter fixation constitutes important care in the maintenance of this device and in the prevention of complications.^{3-4,9,13-15}

Hand hygiene practice stands out as the main measure for preventing and controlling HAIs because of its effectiveness, practicality and low cost.¹⁶ It has been recommended in specific guidelines such as the strategies of the five moments for hand hygiene and the first challenge of the World Health Organization for patient safety.⁶ Despite its importance, this practice was neglected by the observed professionals with an adherence rate of less than 10% before all catheter handlings. Its recommendation is unquestionable, but the clarity of the indications for explicit patient care in the five moments has not been perceived by the professionals in clinical practice.

The five moments were defined with the aim to bring understanding of hand hygiene importance to health professionals in the more frequent care practices in clinical practice.⁶ Nevertheless, the gaps in this audit in adequate adherence were perceived at the right moment, illuminating the need for investment in continuous training and education of professionals.

The adherence rate to hand hygiene was significantly higher after handlings, demonstrating the care of professionals at that moment in relation to occupational health; but on the other hand, it

proved to be below that required for safe care when compared to similar studies,¹⁷⁻¹⁸ which showed adherence being higher than 80.0%. Despite the poor adherence to hand hygiene, procedure gloves were used in 92.8% of the handlings, which is unacceptable since the risk of contact with biological material would require its use in 100% of the occurrences.

Gloves alone are not sufficient to prevent HAI transmission and do not fully protect healthcare workers against microbial agents; it also does not exempt them from properly sanitizing their hands, countering the false premise which still needs to be heavily worked on and demystified that wearing gloves makes the hand hygiene procedure unnecessary. Microorganisms can contaminate the hands of health professionals during their removal or through unperceived microperforations. The reverse path may also occur: previously contaminated hands disseminate microorganisms to the environment and the patient being touched and/or handled. Gloves should therefore be used during all patient care activities where there may be exposure to blood and/or other bodily fluids in order to reduce the risk of spreading microorganisms into the environment and transmission from the health professional to the patient and vice versa, as well as from one patient to another.¹⁹⁻²⁰ It is emphasized that the use of this Personal Protective Equipment does not replace hand hygiene, which must also be performed before and after using gloves.⁶

Regarding the type of hand hygiene used by professionals, a trend towards simple hygiene was observed. In urinary catheter handling, antiseptic friction (use of alcoholic preparations) and simple hygiene (use of water and soap) are recommended, with the latter being mandatory when the hands are visibly dirty or contaminated with body fluids, and after the use of the procedure gloves - in this study, due to the presence of talc. Simple hygiene followed by antiseptic friction was observed in this investigation on two occasions of isolated urinary catheter handling. The consecutive use of these techniques is not recommended, as it is considered inappropriate behavior. In addition to the waste of resources, they do not contribute to reducing cross-transmission of micro-organisms and can also cause dermatitis.⁶

Another relevant aspect in this study was the non-compliance with hygiene of the urethral meatus (22.9%). Studies evaluating bladder catheter care in critically ill patients also pointed to professionals' negligence in relation to such practice.²¹⁻²² The daily hygiene of the urethral meatus should preferably be performed during the patient's bath using water and soap in order to decrease bacterial colonization.³⁻⁴ This technique is an important measure in reducing the risk of CAUTI, since the bacteria colonized in the urethral meatus ascend to the bladder after insertion of the urinary catheter, between the catheter and the urethral mucosa through the extraluminal (biofilm) of the catheter - the most common. The ascent can also occur by the intraluminal route, when the microorganisms penetrate by the light of the device.^{2-3,23}

The source of microorganisms which cause CAUTI may be endogenous, typically through the urethral or exogenous meatus, through contaminated hands of health professionals due to a breakdown of aseptic techniques in handling the catheter and its drainage system.³⁻⁴

Thus, it is important for the team to fully adhere to the recommended prevention measures in order to interrupt the transmission chain and prevent CAUTI occurrence and to reduce colonization (use of the closed drainage system, urethral meatus hygiene and hand hygiene) and the ascent of microorganisms through the bladder catheter (adequate fixation, adequate maintenance of the collector bag, volume and urinary flow), as well as attention to the really necessary usage time of the urinary catheter.^{3-4,23}

The rates presented as results of the performance indicators are not sufficient to assess risk conditions for CAUTI. They should be contrasted with process indicators through clinical practice audits, as conducted in this study. Indirect surveillance often presents adequate indicators, but they are almost always incompatible with on-site observations/audits, which reaffirms that results of isolated

measures may be misleading for planning consolidated actions and do not have the desired effect in reducing CAUTI rates.

To overcome the gap between evidence-based recommendations for CAUTI prevention and clinical practice, the first step is to identify and correct non-conformities.²² Multiple, well-designed interventions such as those developed in the bundle are able to reduce the number of healthcare-associated infections.²⁴ Their implementation requires knowledge and adherence to preventive measures, technical ability and periodic training by all of the multidisciplinary team. Process indicators are a useful tool to do this, since they enable systematic evaluations of the interventions and consequently propositions of directed and structured educational strategies, since the inadequacy of a single indicator is sufficient for CAUTI to occur.^{3,11,24-27}

Regarding limitations of the present study, it can be pointed out that the study only being carried out in one institution restricts extrapolation or comparison of the results, possibly interfering in its external validity.

CONCLUSION

Although most of the process indicators for urinary catheter maintenance and handling achieved satisfactory indices of adequacy, overall compliance was impaired. Although the unit has a prevention and control protocol, through this audit it was possible to identify non-adherence by the professionals to the preventive measures based on scientific evidence established in the guidelines. The gap in prevention is in the awareness by health professionals that the measures recognized for preventing catheter-associated urinary tract infection should be adopted collectively. The identification of gaps in clinical practice should be seen as the main strategy for planning punctual interventions, as well as to form an organizational culture that values care quality and patient safety.

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NOTES

CONTRIBUTION OF AUTHORITY

Study design: Mota EC.

Data collect: Mota EC.

Data analysis and interpretation: Mota EC.

Discussion of the results: Mota EC.

Writing and / or critical review of content: Oliveira AC.

Review and final approval of the final version: Oliveira AC.

ETHICS COMMITTEE IN RESEARCH

Approved by the Ethics Committee in Research with Human Beings of the *Universidade Federal de Minas Gerais*, under opinion no.2,069,140 and Certificate of Presentation for Ethical Appreciation: 66149217.3.0000.5149.

CONFLICT OF INTEREST

There is no conflict of interest.

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