



Nephroprotection associated with the use of iodinated contrast: nursing care

Nefroproteção relacionada ao uso de meio de contraste iodado: atenção de enfermagem

Nephroprotection de pacientes antes del uso de los medios de contraste yodados durante pruebas radiológicas: cuidado de enfermería

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ABSTRACT

Objective: To analyze studies published on CIN, its prevention and the nurse's role in this action, as well as to consider nursing interventions. **Methods:** This review was performed using books, serials, and the databases MEDLINE, SciELO, LILACS, published the 1997 a 2007. **Results:** Since they are directly involved in the CIN administration procedure, the nursing staff plays a relevant role in patients' nephroprotection by trying to identify risk factors and implementing protocols to prevent complications related to the use of iodinated contrast media. **Conclusion:** Knowing itself that the ways of contrast can generate different types of adverse reactions in the patients, the nurse becomes important to be qualified scientific, to recognize these injury and thus to implement pertinent, efficient interventions and that they minimize the complications.

Keywords: Kidney disease/nursing; Kidney diseases/chemically induced; Contrast media/adverse effects; Renal insufficiency, acute

RESUMO

Objetivo: Analisar estudos publicados sobre Nefropatia induzida por contraste, sua prevenção e o papel do enfermeiro nesta ação, bem como, propor intervenções de enfermagem. **Métodos:** Foi realizada revisão de literatura nas bases de dados MEDLINE, SciELO, LILACS, publicados de 1977 a 2007. **Resultados:** Em âmbito nacional não encontramos estudos quando associamos aos descritores nefroproteção e meio de contraste iodado a palavra enfermagem. Identificamos que na prática clínica o procedimento de hidratação antes do uso de meio de contraste é o mais utilizado. **Conclusão:** Sabendo-se que os meios de contraste podem gerar diferentes tipos de reações adversas nos pacientes, torna-se importante o enfermeiro estar habilitado cientificamente, para reconhecer estas injúrias e, assim, implementar intervenções pertinentes, eficazes e que minimizem as complicações.

Descritores: Nefropatias/enfermagem; Nefropatias/induzido quimicamente; Meios de contraste/efeitos adversos; Insuficiência renal aguda

RESUMEN

Objetivo: Analizar estudios publicados sobre Nefropatía inducida por contraste, su prevención y el papel del enfermero en esta acción, así como, proponer intervenciones de enfermería. **Métodos:** Se realizó la revisión de literatura en las bases de datos MEDLINE, SciELO, LILACS, publicados de 1997 a 2007. **Resultados:** En el ámbito nacional no se encontró estudios cuando se asoció a los descriptores nefroprotección y medio de contraste yodado la palabra enfermería. Identificamos que en la práctica clínica el procedimiento de hidratación antes del uso de medio de contraste es el más utilizado. **Conclusión:** Sabiéndose que los medios de contraste pueden generar diferentes tipos de reacciones adversas en los pacientes, se torna importante que el enfermero esté habilitado científicamente, para reconocer estas lesiones y, así, implementar intervenciones pertinentes, eficaces y que minimicen las complicaciones.

Descriptores: Nefropatías/enfermería; Nefropatías/inducido químicamente; Medios de contraste/efectos adversos; Insuficiencia renal aguda

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INTRODUCTION

Contrast-induced nephropathy (CIN) is one of the most common causes of acute renal failure acquired in the hospital environment (12%). Though it can evolve benignly, it is more commonly associated to longer hospitalization time, higher mortality and increased health care costs⁽¹⁾. With the increasing number of therapeutic and diagnostic exams appearing in the market and increasingly being used as therapeutic and diagnostic strategy, it is expected that this issue will become more frequent. Therefore, the CIN can be a potential complication in these procedures, and several studies have looked at it with the aim to understand its pathophysiology and develop preventive actions.

The iodine contrast media (ICM) filtration is performed by the glomerulus in an entirely free manner, without the renal tubule participation to be expelled or re-absorbed. Its renal depuration, in a normal-functioning kidney, has an average lifetime of 30 to 60 minutes, like creatinine⁽²⁾.

The CIN is defined as an absolute raise in the serum creatinine, of 0.5 to 1 mg/dL, or raise of more than 25% to 50% in the basal serum creatinine, evaluated between 48 hours and 72 hours after the contrast media's administration⁽¹⁾.

OBJECTIVE

To analyze published studies about CIN, its prevention and the role of the nurse in this action, as well as to propose nursing interventions according to the Nursing Intervention Classification.

METHODS

For this descriptive study a literature review of serials and of the Medical Literature Analysis and Retrieval System on-line (MEDLINE), Scientific Electronic Library on-line (SciELO) and Literatura Latino-Americana Caribe em Ciências da Saúde (LILACS) databases was performed, using the following keywords: nephroprotection, nursing, and iodinated contrast media. The descriptors were crossed using the Boolean term "and". The studied period was from 1997 to 2007 and original articles in Portuguese, English and Spanish were selected. No restrictions were established concerning the study outline.

For data collection, a specific instrument was designed in Word format with the following topics: article identification, publishing year, type and results.

After selecting the articles, it was possible to identify a brief profile of the contrast media-induced nephropathy.

RESULTS

Most studies on CIN were in the medical area, since, when the research was performed in the databases, in the established period, no publications were found in Portuguese, English or Spanish when the keywords nephroprotection and contrast media were crossed with the word nursing, using the Boolean resource "and".

Nine of the medical articles were from the MEDLINE database, eight from SciELO and one from LILACS.

The material was selected through exploratory reading of 34 articles. The full text of the articles were then read in order to choose which ones met to the study's objectives. The sample was limited to 18 articles.

Regarding the study outline of the assessed articles, it was evidenced in the sample that 12 are literature reviews, four are prospective studies, and two retrospective studies.

When observing the articles' origins, it was found that most were from the United States, with a smaller and almost insignificant national production, and most in the hemodynamic area.

As to the publication period, it was observed there was a greater production over the last five years, mainly national articles. Maybe this fact is related to the significant increase in imaging diagnosis centers, where the use of iodinated contrast media is often.

DISCUSSION

Since the nursing staff is directly related to the MCI's administration procedure, both in the hospital and in the ambulatory environment, they have a key role in the identification of risk factors to its development and in the prevention of complications related to its use. Therefore, to establish an adequate nursing care plan, its mechanism should be presented.

It is believed that the pathophysiology of contrast-induced nephropathy is multi-factorial, with contributions from both vascular and tubular factors in its onset⁽¹⁾.

Small hemodynamic alterations are enough for the renal medulla to become susceptible and unbalance the demand and supply of tissue oxygen. The contrast media, Hyperosmolar solution, in contact with the renal vascular bed initially causes a vasodilatation that lasts a few seconds, and increases the renal blood flow; with a posterior long vasoconstriction. During this period, there is a reduction in the renal blood flow and the glomerulus filtration rate⁽³⁾.

The literature reports several factors in the literature as responsible for vasoconstriction: calcium ions, reduced endogenous vasodilator production (nitric oxide and

prostaglandin⁽⁴⁾, and presence of hypercholesterolemia⁽⁵⁾, adenine, and endothelin⁽⁶⁾.

The oxygen free radicals also appear as a cause of renal lesion, which are produced by the contrast media. This fact is evidenced by the increase in lipid peroxidation (oxidative stress marker) found in animals after administrating this agent⁽⁷⁾.

A few hours after the ICM infusion, there is an increase in the urate excretion, favoring the tubular obstruction in dehydrated individuals⁽⁸⁾.

The identification of pathologic alterations in the epithelial cells suggests the direct toxic effect that the ICM can cause. They are characterized by the proximal epithelial cell's vacuolization, interstitial inflammation and increase of enzymuria after using this agent. These alterations disappear in a few days⁽⁹⁾.

Risk Factors

There are many risk factors developing CIN: male gender⁽¹⁰⁾, age (over 60 years), previous renal function loss (Cr>1.5 mg/dL), acute myocardial infarction, heart failure, diabetes mellitus, peripheral vascular disease, dehydration, use of great quantities of contrast medium^(6,11), hypoalbuminemia, hyponatremia⁽¹²⁾, associated use of nephrotoxic drugs⁽¹³⁾ and atherosclerotic diseases (atheroembolic phenomenon)⁽¹⁰⁾.

In the hemodynamic studies, especially in the coronary interventions, other factors for CIN were observed: arterial hypertension, emergency procedures, left coronary approach⁽¹⁴⁾. Based on these findings, it became necessary to make an adequate anamnesis of these patients, before using these agents. The nurse, through institutional protocols and specific instruments, should identify the risk factors and, along with the multidisciplinary staff, intervene to prevent problems from using this agent.

Clinical Picture

The majority of patients with CIN evolves with increase of the serum creatinine without symptoms, without oliguria and is reversible⁽¹⁵⁾. Serum creatinine reaches its greater serum level in 3 to 5 days (approximated increase of 0.5 to 3 mg/dl). This situation can be normalized in 7 to 14 days in average⁽¹⁰⁾ or the acute renal failure can install itself and last for four weeks⁽⁸⁾.

Acute renal failure becomes more severe in high risk patients. In most prospective studies, the clinical picture in this situation manifests with the presence of oliguria 24 hours after the procedure, in the most part transitory and that lasts from 2 to 5 days; serum creatinine level elevation over 5 mg/dL, with peak between 5 and 10 days and return to original level in 14 to 21 days⁽¹⁶⁾.

The urine exam (urinalysis) can present alterations in

the sodium excretion fraction, temporary proteinuria and enzinuria, signals that, in general, are not reliable to conclude the diagnosis⁽¹⁷⁾.

Prevention

There are many prophylactic measures that have been used to prevent CIN. The most stated in the literature are: hydration and drug use.

In 92% of the identified studies about nephrotoxicity prevention, it was observed a constant recommendation for hydration in its protocols, since dehydration is a well defined risk factor for the reduction or loss of renal function after contrast media use^(1,18). The hydration can be achieved either by oral or intravenous means, according to the referred literature, and there is no comparison about the best way of doing it. With the hydration, an effort should be made to keep a positive fluid balance, with high urinary debit. It is necessary the total hydric balance rigorous control, to adjust the hydration as necessary.

There still is no standardized protocol for hydration, but some authors recommend using infusion rates of 100 to 150 ml/h or 1.0 to 1.5 ml/kg/h, with the objective of reaching a urinary volume of 75 ml to 125 ml/h⁽¹⁹⁾.

Studies demonstrate that the hydration regime using saline isotonic solution and hypotonic serum (sodium chloride 0.45% plus glucose 5%) 12 hours before, and after the ICM use, is more effective than hydration with physiologic solution in 0.9%^(1,4,6,8-20).

Regarding medicines, some studies shown the use of acetylcysteine (antioxidant) associated to hydration as an attenuating therapy against acute renal failure in risk patients⁽²¹⁾. However, when ICM greater than 140 ml is used (low osmolarity non-ionic contrast), this therapy has not proven effective⁽²²⁾.

Acetylcysteine also has vasodilator proprieties, increasing the renal hemodynamic conditions⁽²³⁾. Some authors did not find any additional benefit in using acetylcysteine in patients subjected to percutaneous coronary intervention⁽²⁴⁾.

Theophylline, a calcium canal blocker, dopamine and atrial natriuretic peptide, despite its application in the clinical practice, have not been proven in terms of its effectiveness in most of the analyzed studies^(1,4-18).

Prostaglandin is a drug that is also used to prevent CIN, but more studies are needed to investigate its action⁽¹⁸⁾.

As to ascorbic acid, a study identifies that vitamin C, because of its oxidant action, can be used in the acute renal failure prophylaxis, for it is a safe drug, with good tolerance and low cost⁽²⁵⁾.

Mannitol and furosemide have not presented the desired nephroprotection effects; on the contrary, they

can cause deleterious effects, because they cause depletion of the extra-cellular spaces, increasing the risk of nephrotoxicity of the contrasting agents^(15, 18).

Since no specific protocols for CIN prevention were identified in the researched literature, both in the medical area and in the nursing area, the nursing interventions were listed according to the Nursing Interventions Classification (NIC), due to the need for a standardized language and the belief that nursing care must occur in a systematized way.

NIC represents one of the most modern proposals related to nursing actions. It is composed of 486 interventions and more than 12 thousand activities, articulated to the NANDA nursing diagnosis classification⁽²⁶⁾.

Thus, the nursing interventions were proposed, by the authors, based on the framework presented above.

Two suggested main nursing interventions are related to the Nursing Diagnosis (ND) Ineffective Tissue Perfusion: renal type, which has, by definition, reduced oxidation, resulting in the incapacity to nurture the tissues in capillary level²⁷. This ND is related to the actions of iodized contrast medium: vasoconstrictor effect, which stimulates medullar ischemia, and the direct toxic effects over the tubular function, which includes direct cellular injury, tubular obstruction and osmotic alterations⁽¹⁶⁾.

Through therapeutic trials, the following interventions and activities are proposed, and should be established by the multidisciplinary team (physicians, nurses and radiology technicians):

Level 1 Interventions: domain 3 – Physiological: complex:

1) ELECTROLYTE CONTROL

Activities: monitor abnormal serum electrolyte levels and the central nervous system;

2) FLUID CONTROL

Activities: monitor cardiopulmonary manifestations (PA, FC and FR); stimulate oral ingestion and administer, by intravenous injection, hypotonic saline solution SF 0.45% - 12 hours before and after the exam, or quick infusion of 100 ml/h for 3 hours, hypotonic dextrose (5%), based on the liquid state (hydration – membrane, mucosa and pulsation), in the injected volume, in the calculation of insensible losses (sweat, breathing) and in the urinary osmolarity as per institutional protocol.

CONCLUSIONS

This revision was performed with the purpose to search for adequate evidence of effective nursing interventions to identify risk factors and acute renal failure after the use of iodized contrast medium in radiology exams. It showed that further studies and specific attention are needed on this matter.

Since the contrast medium can cause different kinds of adverse reactions in patients, it is important for the nurse to be scientifically able to recognize these problems and plan appropriate and effective interventions to minimize the complications.

Even in medical studies, there are still many questions about the best course of action to prevent CIN. This shows the need for interdisciplinary discussions to provide better tracking and protocol proposals that would facilitate this process.

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