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Critically Appraised Topic / Évaluation critique

Canadian Association of Radiologists Consensus Guidelines for the Prevention of Contrast-Induced Nephropathy: Update 2012

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Abstract

Purpose: Contrast-induced acute kidney injury or contrast-induced nephropathy (CIN) is a significant complication of intravascular contrast medium (CM). These guidelines are intended as a practical approach to risk stratification and prevention. The major risk factor that predicts CIN is pre-existing chronic kidney disease.
Methods: Members of the committee represent radiologists and nephrologists across Canada. The previous guidelines were reviewed, and an in-depth up-to-date literature review was carried out.
Results: A serum creatinine level (SCr) should be obtained, and an estimated glomerular filtration rate (eGFR) should be calculated within 6 months in the outpatient who is stable and within 1 week for inpatients and patients who are not stable. Patients with an eGFR of $\geq$ 60 mL/min have an extremely low risk of CIN. The risk of CIN after intra-arterial CM administration appears be at least twice that after intravenous administration. Fluid volume loading remains the single most important measure, and hydration regimens that use sodium bicarbonate or normal saline solution should be considered for all patients with GFR $<$ 60 mL/min who receive intra-arterial contrast and when GFR $<$ 45 mL/min in patients who receive intravenous contrast. Patients are most at risk for CIN when eGFR $<$ 30 mL/min. Additional preventative measures include the following: avoid dehydration, avoid CM when appropriate, minimize CM volume and frequency, avoid high osmolar CM, and discontinue nephrotoxic medications 48 hours before administration of CM.

Résumé

Objet : L'insuffisance rénale aiguë provoquée par un produit de contraste, ou néphropathie provoquée par un produit de contraste (NPPC), est une complication importante secondaire à l'injection intravasculaire d'un produit de contraste. Les présentes lignes directrices constituent une approche pratique en matière de stratification des risques et de prévention. Le principal facteur de risque associé à la NPPC est la néphropathie chronique.
Méthodes : Les membres du comité de consultation représentent les radiologistes et les néphrologues de partout au Canada. La version précédente des lignes directrices a été révisée et une nouvelle analyse documentaire détaillée a été menée.
Résultats : La créatinine sérique (SCr) et le taux de filtration glomérulaire (TFG) doivent être obtenus dans les six mois précédant une injection de produit de contraste chez les patients en consultation externe dont l'état est stable, et dans la semaine précédente dans le cas de patients hospitalisés ou dont l'état est instable. Les patients dont le TFG est égal ou supérieur à 60 ml/min présentent très peu de risques de développer une NPPC. On estime que les risques de développer une NPPC à la suite de l'administration intra-artérielle d'un produit de contraste sont deux fois plus élevés que ceux associés à l'injection intraveineuse du produit. L'hyper-hydratation demeure la mesure préventive la plus importante. Des protocoles d'hydratation à base de bicarbonate de sodium ou d'une solution saline standard devraient être envisagés pour tout patient dont le

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TFG est inférieur à 60 ml/min, lorsque le produit est administré par voie intra-artérielle, et pour tout patient dont le TFG est inférieur à 45 ml/min, lorsque l'administration se fait par voie intraveineuse. Les patients dont le TFG est inférieur à 30 ml/min sont les plus susceptibles de développer une NPPC. Parmi les autres mesures préventives nous suggérons notamment : éviter la déshydratation; éviter si possible l'utilisation de produits de contraste; réduire au maximum le volume et la fréquence d'administration du produit de contraste; éviter l'utilisation de produits de contraste hyperosmolaires et suspendre la prise de médicaments néphrotoxiques 48 heures avant l'administration d'un produit de contraste.

Key Words: Contrast-induced nephropathy; Contrast-induced acute kidney injury; Chronic kidney disease; Acute renal failure; N-Acetylcysteine; Metformin

Contrast-induced nephropathy (CIN) is the development of acute kidney injury (AKI) after the administration of radiographic contrast media (CM) in the absence of other identifiable causes and is widely accepted as a leading cause of hospital-acquired AKI. Radiologists play a pivotal role in the responsible use of CM and in the implementation of preventative measures to reduce the risk of CIN. These guidelines are meant to represent a practical and implementable approach to the identification and management of patients at risk of CIN.

Prospective studies of patients admitted with AKI demonstrate that intravascular CM was responsible or contributory in 11%-14.5% of cases [1–3], which supports the widespread view that CIN is one of the leading causes of AKI. The development of AKI is thus considered a significant complication of radiographic CM use and has been linked with both excess morbidity and mortality [4,5]. The most common procedures associated with CIN in those studies are coronary angiography and contrast-enhanced computed tomography (CT). The use of contrast-enhanced CT is increasing rapidly, and the total amount of CM used in radiology departments is also increasing [5]. These factors, coupled with an increased incidence of chronic kidney disease and an aging population, will result in an increased incidence of CIN unless effective preventative measures are taken. Before contrast is administered, patients should be fully assessed, and precautions must be taken with patients with renal impairment. Implementation of prevention strategies is considered to be the best approach to reducing the development of CIN [6].

Methodology

Members of the committee represent interventional and diagnostic radiologists and nephrologists across Canada. The previous guidelines [7] were reviewed, changes in guidelines from individual radiology departments in Edmonton, Ottawa, and Oshawa were also reviewed. An in-depth up-to-date literature review was carried out to encompass new publications. A consensus document was drawn up by the lead author and reviewed by all members of the committee before release of the final document. The document was then made available to stakeholders and Canadian Association of Radiologist (CAR) members for review before CAR board review and availability on the CAR Web site.

Definition of CIN

CIN is an acute decline in renal function that occurs 48-72 hours after intravascular injection of CM [7]. The most common definitions in use are an increase in serum creatinine (SCr) level of >25% of the baseline value or an absolute increase in the SCr level by at least 44 μmol/L that occurs after the intravascular administration of CM without an alternative explanation [8]. SCr usually peaks 48-72 hours after CM use and returns to the baseline within 14 days; however, some patients may progress to acute kidney injury that requires dialysis [9].

Renal Function Estimates

Renal impairment can be expressed by using a variety of indices of renal function, including the SCr level, glomerular filtration rate (GFR), and creatinine clearance (CrCl) [10]. GFR and CrCl are to all intents and purposes similar, and although there is variance, particularly when there is a profound reduction in renal function (due to a compensatory increase in tubular secretion), for the purposes of this document, they are considered interchangeable. Despite widespread use in clinical practice, the SCr level, as an absolute measure, is an unreliable indicator of kidney function. GFR is considered to be a more appropriate index of kidney function and can be estimated from the SCr level (see below) [11].

Clinical Outcomes

CIN remains one of the most serious adverse effects associated with the use of CM [12]. Patients with CIN experience more systemic and cardiac in-hospital complications than patients without CIN [4]. In-hospital death rates increase significantly among patients with CIN, as do the number of days in the intensive care unit, number of days in the hospital, and the need for dialysis [1,11]. Among patients who require dialysis, the median 2-year survival rate is 19% [1]. Even patients who do not require dialysis have dramatically increased mortality rates at 1 year [13].