"POST HOC NON DEINDE PROPTER HOC": THE ROLE OF CONTRAST NEPHROPATHY IS OVERESTIMATED IN HOSPITALISED PATIENTS

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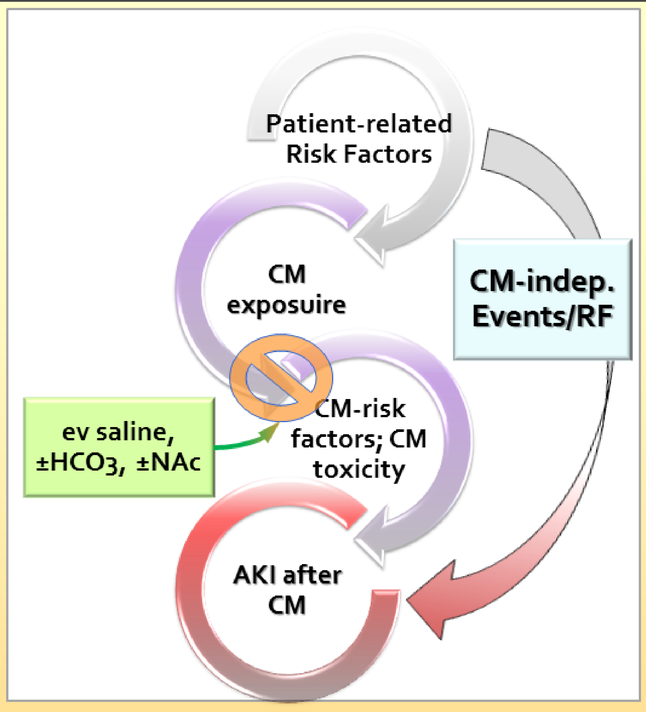
BACKGROUND and AIM

Contrast-induced nephropathy (CIN) is considered one of the most common forms of iatrogenic acute kidney injury (AKI) and is usually diagnosed on the basis of an absolute (≥ 0.5 mg/dL) or relative (≥ 25%) elevation in serum creatinine (sCr) within 48-72 hours after exposure to a contrast medium (CM).

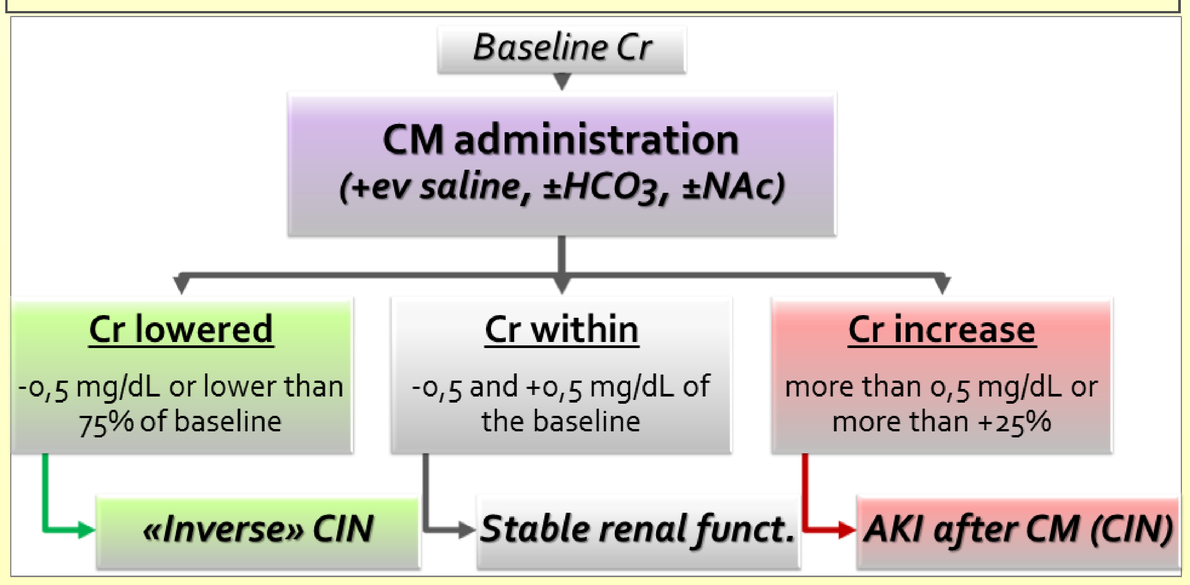
Reported incidence of CIN is extremely wide, ranging from 1-2% up to 33% in different settings, as well as prognosis, ranging from 0.4% to 5% for dialysis and 6.4-34% for death.
These too heterogenous data indicate that the current definition of CIN is too loose and may include different conditions which can cause acute kidney injury (AKI) after contrast medium (CM) but are in fact independent of it.



Therefore we performed a prospective study to evaluate the real prevalence of AKI following CM injection in a population of hospitalized patients, together with a careful analysis of all the clinical peri-procedural risk factors - including CM- to perform potential differential diagnosis between CIN and other concurrent causes of AKI.

PATIENTS and METHODS

Study population
All the hospitalized patients who performed radiological exams with CM through intra-venous (i.v.) or intra-arterial (i.a.) administration route, including CT scans, angiography and coronarography
Single Center, between November 2012 and August 2013
at least one determination of Creatinine within 1 week before CM administration
at least one determination of Creatinine within 72 hours after CM administration
Risk factors and confounders:
Patient-related: CKD, diabetes, hypertension, ischemic heart disease, monoclonal para-proteins, renal transplant recipients, sepsis, shock, arrhythmia, nephrotoxic drugs
CM-related: urgency, route (ia vs iv), volume (normalized by eGFR)



RESULTS

429 patients

550 CM exposures

324 urgent exam (58,9%)

163 i.a. route (29,6%)

387 i.v. route (70,4%)

Renal outcomes after CM			
	n/N	%	P vs stable Cr
AKI/CIN	**23**	4,2%	-
Dialysis	*1/23*	*4,3%*	0,09
Death	*4/23*	*17,4%*	0,02
Stable Cr	**474**	86,2%	-
Dialysis	*1/474*	*0,2%*	-
Death	*20/474*	*4,2%*	-
Inverse CIN	**53**	9,6%	-
Dialysis	*0*	*0*	0,89
Death	*1/53*	*1,9%*	0,36

Multivariate logistic regression analysis for CIN

The only risk factor for development of AKI-after-CM/CIN was hemodynamic instability due to sepsis, shock, cardiac rhythm alterations (OR = 61, 95%CI: 17-215) whereas baseline renal function, CM volume and route of administration (i.a vs. i.v.) were not statistically significant.

"Inverse CIN"

Surprisingly, "inverse CIN" characterized by specular criteria as compared to CIN, that is an absolute (≥ 0.5 mg/dL) or relative (≥ 25%) improvement in sCr within 48-72 hours after exposure to a CM, was diagnosed in 53/550 examinations (9,6%).

Comparison between "inverse CIN" versus CIN patients showed that the former was strongly associated with adoption of i.v. hydration protocol (OR 62, IC 3.788-1027), had a worse baseline renal function (53 mL/min vs 62 mL/min, p<0.0001) and had received a higher CM volume (mean volume/function ratio: 4.3 vs 3.3, p<0.0001).

CONCLUSIONS

1. This prospective study demonstrates that there is a pitfall in diagnosing as "CIN" any case of AKI following CM injection.
   - AKI-after-CM has a multi-factorial etiology, including as ***the main causal/risk factor is hemodynamic instability***.
   - The ***paradoxical features of patients with "inverse CIN"*** (in which renal function improves after CM despite a worse baseline renal function and a higher CM volume) suggest that the nephrotoxic potential of CM *"per se"* is negligible if i.v. hydration is performed.
2. Therefore the present diagnostic criteria for CIN -which are mainly "time-based"- might lead to misleading conclusions, like establishing an undue causal link between CM and AKI, ***as time-correlation does not equal causation***, i.e. "*post hoc non deinde propter hoc*".
3. The overestimation of CM-mediated renal damage, ignoring contingent periprocedural conditions (that are the true "risk factors" for post-CM injection-AKI) might eventually lead to the risk of avoiding important CM-based radiological examinations in patients with CKD.

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