



بسم الله الرحمن الرحيم

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تم رفع هذه الرسالة بواسطة / مني مغربي أحمد

بقسم التوثيق الإلكتروني بمركز الشبكات وتكنولوجيا المعلومات دون أدنى

مسئولية عن محتوى هذه الرسالة.

ملاحظات: لا يوجد





Effect of contrast agent on renal functions in patients with renal impairment undergoing percutaneous coronary intervention

Thesis

*Submitted for Partial Fulfillment of Master Degree in
Cardiology*

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2022

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INTRODUCTION

CIN has acquired expanded consideration in the clinical setting, especially during heart mediation yet additionally in numerous other radiological techniques in which iodinated contrast media are utilized. There is at present great clinical proof from all around controlled randomized examinations that CIN is a typical reason for intense renal dysfunction[1,2]. CIN is the intense decay of renal capacity after parenteral organization of radiocontrast media without different causes. CIN is by and large characterized as an expansion in serum creatinine grouping of >0.5 mg/dL (>44 μ mol/L) or 25% above gauge in something like 48 hours after contrast administration[3-7].

Albeit the specific systems of CIN still can't seem to be completely clarified, a few causes have been portrayed. Expanded adenosine-, endothelin-, and free revolutionary instigated vasoconstriction and decreased nitric oxide-and prostaglandin-prompted vasodilatation have been noticed. These systems cause ischemia in the more profound part of the external medulla, a region with high oxygen necessities and remote from the vasa recta providing the renal medulla with blood. Contrast specialists additionally have direct poisonous consequences for renal rounded cells, causing vacuolization, modified mitochondrial work, and apoptosis[8]. Atopy doesn't assume a part in the pathogenesis of CIN.

The frequency of CIN in everybody has been determined to be $<2\%$. In high-hazard patients, i.e., patients with constant renal

impedance, diabetes mellitus, congestive cardiovascular breakdown, and more established age, the occurrence has been determined to be >20% to 30%[3-7]. CIN has been related with expanded dismalness, broadened length of medical clinic stay, and expanded costs[9]. A few gamble factors have been portrayed for CIN[10-12]. A gamble score for forecast of CIN after percutaneous coronary mediation has been accounted for by Mehran et al.[12] That hazard score incorporates hypotension (5 focuses, assuming systolic pulse <80 mm Hg for no less than 1 hour requiring inotropic support), utilization of intra-aortic inflatable siphon (5 focuses), congestive cardiovascular breakdown (5 focuses, if class III/IV by New York Heart Association grouping or history of pneumonic edema), age (4 focuses, if >75 years), pallor (3 focuses, if hematocrit <39% for men and <36% for ladies), diabetes mellitus (3 focuses), contrast media volume (1 point for each 100 mL), assessed glomerular filtration rate (GFR; GFR in mL/min per 1.73 m²; 2 focuses, if GFR 60 to 40; 4 focuses, if GFR 40 to 20; 6 focuses, if GFR <20). A gamble score of <6, 6 to 10, 11 to 16, and >16 shows a gamble for CIN of 7.5%, 14%, 26%, and 57%, respectively.[12] It should be accentuated that higher difference volume is a significant gamble factor for CIN[10-12]. Albeit no distinct confirmation has been gotten at this point, the gamble of nonsteroidal mitigating medications or angiotensin-changing catalyst inhibitors over to compound CIN has been accounted for due to their impacts on renal perfusion or tubulotoxicity[13,14]. It is consequently certain that CIN is a possibly hurtful condition. The explanation that issues appear to be expanding is that the

quantity of angiographies and CT assessments in clinical practice is expanding, and today higher dosages are directed to more ailing and more established patients[3-7,15].

AIM OF THE WORK

This study plans to foresee the impact of difference specialists on renal capacities in patients with renal debilitation going through percutaneous coronary intercession.

CONTRAST INDUCED NEPHROPATHY

Introduction

Expanding utilization of differentiation media during radiological techniques has brought about an expanding occurrence of difference actuated nephropathy (CIN), an iatrogenic problem brought about by openness to differentiate material.

CIN is a perplexing disorder of intense renal disappointment happening after the organization of iodinated contrast media. The definition remembers outright or relative increment for creatinine level after openness to balance specialist contrasted and standard worth, when elective clarifications for renal debilitation have been prohibited. It happens inside 24-48hr of the openness, with creatinine level regularly topping 3-5 days after system and getting back to gauge or approach benchmark esteem in 1-3 weeks[1]. The remove expansion in creatinine characterizing CIN varies in different investigations (from 20 to half or in outright qualities from 0.5 to 1.0 mg/dL), making it challenging to think about the outcomes. The most well-known definition utilized of late is $\geq 25\%$ relative increment or an outright increment of ≥ 0.5 mg/dL in serum creatinine from pattern esteem at 48 to 72hr after openness to differentiate media. Based on this definition, the general frequency of CIN in everyone is accounted for to be 1.2 to 1.6%[2,3]. The rate of CIN is significantly higher in chosen subsets of patients with

cardiovascular pathology, which isn't shocking given the high pervasiveness of hazard factors for CIN in this populace. Based on the information library of the Mayo Clinic including 7,586 patients who went through percutaneous coronary intercessions (PCI), the occurrence of CIN was 3.3%[4]. In a more modest investigation of McCullough et al.[5] that dissected information on 1,826 patients going through PCI, CIN happened in 14.5% of the cases. Dialysis because of CIN in these two series was expected in 0.7% and 0.3% of patients, individually.

Pathogenesis of CIN

The pathogenesis of CIN isn't plainly perceived. Hitherto, a few pathophysiological components of CIN have been proposed, including direct harmfulness to renal rounded epithelium, oxidative pressure, ischemic injury, and cylindrical obstruction[6,7]. Low blood stream in the medulla prompting medullary hypoxia could result from expanded perivascular hydrostatic tension, expanded intratubular pressure auxiliary to differentiate incited diuresis, vasoconstriction because of redundance of vasoactive substances as adenosin and endothelin, and diminishing of nitric oxide and prostaglandins[8,9]. Discharge of the difference medium requires huge pee volume to clear the osmotic burden. Openness of renal tissues to high osmotic burdens brings about trademark histopathologic changes called "osmotic nephrosis" Changes predictable with osmotic nephrosis were seen in 22.3% of patients going through renal biopsy in the span of 10 days of differentiation exposure[10].

After infusion of difference media, a transient increment is trailed by a more drawn out decline in renal blood stream in creatures and humans[11]. Endothelin-1 has been ensnared as the most probable causative specialist in various studies[12,13]. The vasoactive impact of adenosine in various organs is reliant upon the proportion of adenosine A1 and A2 receptors. In kidneys, as opposed to heart, adenosine causes vasoconstriction and is likewise remembered to assume a part in pathogenesis of CIN because of increment of renal adenosine fixations because of improved adenosine triphosphate hydrolysis[14]. Receptive oxygen species, which are produced during hypoxia, additionally presumably add to renal injury[15].

Hazard elements of CIN

Hazard factors for the improvement of CIN have been totally inspected in a few examinations. They might be isolated into two classifications: fixed (nonmodifiable) and modifiable.

The best perceived nonmodifiable gamble factors incorporate more established age, diabetes mellitus, previous renal inadequacy, congestive cardiovascular breakdown, hemodynamic flimsiness, and nephrotic disorder.

Age

The old are at expanded hazard of CIN with detailed frequency of 11% in patients more established than 70 years[3]. The purposes behind higher gamble of creating CIN in the old

have not been concentrated explicitly and presumably are multifactorial, remembering age-related change for renal capacity as decreased glomerular filtration rate (GFR), rounded discharge and focus capacity, as well as more troublesome vascular access requiring more noteworthy measure of differentiation, presence of multivessel infection, and so on Significantly, by multivariate investigation, age more established than 70 years gave off an impression of being a free indicator of CIN in some studies[16-18].

Prior Renal Disease

Prior renal sickness with a raised degree of creatinine is a pivotal gamble factor in the improvement of CIN; rates in patients with fundamental renal issue are incredibly high, going from 14.8 to 55%[4,5,19]. In multivariate investigation, benchmark creatinine addressed an autonomous indicator of CIN in most of the studies[3-5,19]. Conversely, the gamble of CIN is negligible (<10%) in patients who have typical renal capacity at the hour of differentiation medium openness.

Higher pattern creatinine values are related with more serious gamble of CIN[20]. As displayed in concentrate by Hall[21] if benchmark plasma creatinine level is ≤ 1.2 mg/dL, the rate of CIN was just 2%. Nonetheless, in patients with upsides of creatinine in the scope of 1.4-1.9 mg/dL, the rate of CIN expanded to 10.4%, and in patients with benchmark creatinine level ≥ 2.0 mg/dL, 62% created CIN after angiography. A model

that anticipated CIN by the serum creatinine level showed an outstanding expansion in the gamble for nephrotoxicity assuming the pattern level was 1.2 mg/dL or higher[22]. By and large, assessed GFR <60 mL/min/1.73m² is viewed as a remove an incentive for expanded hazard of CIN[23].

Diabetes Mellitus

Diabetes mellitus has been recognized as an autonomous gamble factor for CIN in various studies[3-5,24]. The rate of CIN in diabetics fluctuates from 5.7 to 29.4%[2,25,26]. Given the high pervasiveness of diabetes in everyone and its capacity to cause expansive range of cardiovascular illnesses, which require radiological techniques for their analysis and treatment, diabetic patients address a critical extent of those going through contrast openness. Hazard of CIN is expanded even in diabetics with saved renal function[24,27]. Presence of other gamble factors, like renal deficiency or proteinuria, in diabetics further expands the gamble for CIN. In study by Berns et al.[1], CIN happened in 27% of diabetics with standard serum creatinine 2.0 to 4.0 mg/dL and in 81% of those with serum creatinine >4.0 mg/dL. In a concentrate by Toprak et al.[28], a sum of 421 patients with Cockcroft-Gault assessed creatinine freedom somewhere in the range of 15 and 60 mL/min were isolated into three gatherings: diabetes mellitus (n = 137; glucose $\geq$ 126 mg/dL), pre-diabetes (n = 140; glucose somewhere in the range of 100 and 125 mg/dL), and typical fasting glucose (n = 144; glucose < 100 mg/dL). CIN, characterized as an increment of $\geq$ 25% in creatinine over gauge

inside 48hr of angiography, happened in 20% of diabetics, 11.4% of pre-diabetics, and 5.5% of patients with ordinary fasting glucose level.

Congestive Heart Failure and Hemodynamic Instability

Since diminished renal perfusion is likely a significant component of renal injury in CIN, it isn't is business as usual that few clinical circumstances related with hemodynamic hindrance were displayed to incline toward CIN. Congestive cardiovascular breakdown has been related with expanded hazard for CIN in a few studies[3,4,24,29]. Foremost myocardial localized necrosis as well as marks of hemodynamic precariousness, for example, periprocedural hypotension and utilization of an intra-aortic inflatable siphon, were demonstrated to be indicators of CIN in patients going through essential PCI[29,30].

Renal Transplant

Attendant utilization of nephrotoxic medications (cyclosporine) alongside higher pervasiveness of diabetes and renal inadequacy brings about high gamble of CIN in patients with renal transfer. Ahuja et al.[31] reflectively surveyed the information on 144 patients with working renal allograft who were presented to differentiate media. The rate of CIN was 21.2% in the entire gathering, and was particularly high (42.8%) among the individuals who have not gotten hydration before the strategy.

Volume of Contrast Media

Volume of difference media managed during the system is of essential significance in the advancement of CIN[26]. It is a really modifiable gamble factor for CIN. In any case, developing intricacy of coronary methods unavoidably causes an expanded utilization of difference media per technique and subsequently upgrades the gamble of CIN. The connection between's how much differentiation and the gamble of CIN was reported in various studies[32,33]. As indicated by McCullough et al.[5], the gamble of CIN is insignificant in patients getting <100 mL of difference media.

Nephrotoxic Drugs

It is guessed that associative utilization of nephrotoxic medication and differentiation organization will expand hazard of CIN. Alamartine detailed a pattern toward a higher frequency of CIN ($P=0.07$) in patients getting nephrotoxic medications (counting diuretics, nonsteroidal calming drugs, coxibs, aminoglycosides, amphotericin B)[34]. It is a generally expected clinical practice to stay away from some other nephrotoxic affronts, assuming that it is doable, when contrast medium is managed.

Various investigations looking at changed contrast specialists have been directed. Barrett et al.[37] distributed in 1993 a meta-investigation of 31 randomized preliminaries looking

at low-osmolality contrast media and high-osmolality contrast media. Pooled chances of an ascent in serum creatinine level of more than >0.5 mg/dL with low-osmolality contrast media was 0.61 (95% certainty span [CI], 0.48-0.77) times that after high-osmolality contrast media. The impact of low-osmolality contrast media in decreasing the gamble of an ascent in serum creatinine of >0.5 mg/dL was huge in patients with renal weakness (OR 0.5; CI, 0.36-0.68) however not in those with typical renal capacity (OR 0.75; CI, 0.52-1.1). The creators presumed that utilization of low-osmolality contrast media might be gainful in patients with existing renal disappointment [37]. These finding were affirmed in a forthcoming, randomized, twofold visually impaired multicenter preliminary by Rudnick et al.[19] looking at low-osmolar nonionic difference specialist, iohexol, and the high-osmolar ionic differentiation specialist, diatrizoate, in 1,196 patients going through cardiovascular angiography. Intense nephrotoxicity (expansion in serum creatinine of ≥ 1 mg/dL, at 48 to 72hr postprocedure) was seen in 7% of patients getting diatrizoate contrasted and 3% of patients getting iohexol ($P<0.002$). Contrasts in nephrotoxicity between the two differentiation bunches were restricted to patients with past renal inadequacy or renal deficiency joined with diabetes mellitus.

A pooled examination of 16 twofold visually impaired, randomized, controlled preliminaries ($n=2,727$) looking at nephrotoxicity of iso-smolar balance medium iodixanol with low-osmolar contrast media was as of late published[38]. The most