CONTROVERSIES AROUND FLUIDS AND DIURETICS IN ACUTE KIDNEY INJURY
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ABSTRACT

BACKGROUND
Resuscitation of fluids along with proper and directed use of diuretics is the key to prevent development of acute kidney injury in intensive care settings. Acute kidney injury is associated with a fall in the urine output, many a times prompting the use of diuretics. But its use either in acute or chronic kidney disease has never failed to perturb the treating physicians. Evidences stall tall for and against its use, but this ambiguity seldom affect the prevalence of its use in the clinical practice. Many recent studies stated that the use of diuretics may very well increase the output of urine, but this doesn’t reflect in the overall morbidity status.

METHODS
We studied the percentage of patients admitted, who fell into the trap of acute injury of kidneys, the fluid used for their resuscitation and their effect on the development of kidney injury and also the use of loop diuretic, furosemide in patients admitted to intensive care unit of Department of Medicine, Jawaharlal Nehru Medical College and Hospital, Bhagalpur, for its effect on urine output and requirement of haemodialysis and mortality as against those without the use of diuretics.

RESULTS
There was an apparent increase in the urine output of the patients on diuretics furosemide, but the frequency of requirement of haemodialysis was not any better. Proper fluid resuscitation with IV crystalloids was less commonly reflected as having acute kidney injury.

CONCLUSIONS
Isotonic IV crystalloids should be used for the resuscitation of fluids in ICU care setup and diuretics should not be prescribed routinely, as advocated by the KDIGO, and it should be reserved for the oliguric states with fluid overload.


BACKGROUND
The Crystals of Cure- Critically ill patients in an unprecedented number of situations slip into the well of acute kidney injury (AKI). The figure goes beyond 3/5th of the patients.1 AKI has been found to be linked with an explosion in the morbidity and mortality of the critically ill patients.2 A downfall in the intravascular volume and pressure can decrease perfusion of the kidneys and deteriorate the effect of AKI. Many recent observational studies have supported regarding the negative impacts of fluid overload over the kidney function.3,4 In this background, volume resuscitation, fluid management, and diuretics can be influential in determining the track of the disease. In iniquitous sepsis and septic shock, after the study by Rivers and colleagues, the administration of fluids and vasopressors in the 1st hours of an acute illness has been well calculated one of the most vital interventions en route of better results.5 In volume resuscitation, the preference of the most select repletion fluid remains a baffling enigma remaining to be deciphered. Crystalloids are in disrepute for exacerbating pulmonary and peripheral oedema by escalating fluid extravasation whereas colloids adhere to the intravascular spaces, hence optimizing the quantity of replacement fluid needed, the degree of hypoalbuminemia, and perhaps pulmonary leakiness. Colloids, sadly, have been coupled with an increased risk of complications and unfavourable impacts on kidney function. The Kidney Disease Improving Global Outcome (KDIGO) Clinical Practice Guidelines for AKI have suggested that use of isotonic crystalloids should precede the use of synthetic and non-synthetic colloids for intracellular volume expansion in patients at risk or presenting with AKI, in the nonexistence of haemorrhagic shock.6 This bid was built on the environment of undesirable effects of synthetic colloids over isotonic crystalloids on mortality and other outcomes, including AKI. Cochrane Collaboration group meticulously reviewed 56 randomized controlled trials (RCTs) in 2011 and concluded that colloids are not superior to isotonic crystalloids in terms of mortality when used for intravascular volume repletion. KDIGO also vocalized the use of isotonic crystalloids over colloids in patients at risk or with AKI. Synthetic colloid solutions are better avoided, Hypo-oncotic albumin could be used in patients with sepsis, but it may predispose to infections and also, they should better be avoided in traumatic brain injury. The hyper-oncotic albumin
should be avoided except for cirrhotic patients. Studies suggest that the type of crystalloid solution used may also influence outcomes. The KDIGO recommends expansion of volume with either IV NaHCO3 or normal saline (isotonic) in patients at a heightened danger of contrast induced kidney injury. They go against the lone use oral fluids for the prevention of the same.

On the fateful day of any surgical intervention the use of crystalloids without calcium in it, has been found to be having fewer complications with respect to isotonic normal saline.1 The in-depth study of the randomized evaluation of normal versus augmented levels, trials truly depicted the beneficial effect of correcting the fluid balance in overall mortality and precipitation of the acute kidney injury. In a randomized trial, when the diseased were studied for the prognosticators of mortality, the mean fluid balance was found to be a keystone factor responsible for the same. This not only indicates a negated balance, but an extra load of fluid was also linked with an increase in morbidity and mortality profile. Results from observational studies advocate that an conservative fluid approach may be valuable in terms of mortality and kidney recovery in patients with severe AKI. An acute kidney injury might bring about a fall in output of urine creating a positive fluid balance, further aggravating the situation. It has been found that kidney injury with urine output less than 400 ml per day was found to be linked with relatively troublesome outcomes.8

Use of diuretics in kidney injury be it chronic or acute has never failed to baffle the medical fraternity. Despite of the inconclusive evidences their use is not infrequent. Many randomized trials previously negated the preventive role of diuretics in acute kidney injury. Recent meta-analysis revealed that the diurectic use may very well increase the urine output, thus creating a false sense of renal well-being but unfortunately the overall outcome of the failure status wasn’t found to be any better in terms of mortality or the requirement of renal replacement.9

The clinical practice guidelines for the acute kidney injury (KDIGO) states that the use of diuresis causing agents regulate the fluid balance and allows rather free administration of other drugs and diet. Some diuretics are even said to be capable of preventing renal fallout and re-tracking its recovery. But it is a double-edged sword, it can multiply the pre-rennal damage by inducing a fall in the circulating volume. This necessitates the keen evaluation of diuretics in improving the prognosis of patients with acute kidney injury. Loop diuretics like furosemide may protect the loop of Henle from ischemic injury by reducing the oxygen use, which in turn is due to blocking of active transportation of sodium across the medullary tubular segment.10 The loop diuretics can also root out the necrotic waste by blocking the prostaglandin dehydrogenase thus increasing the blood flow to the kidneys.11,12 Theoretically these diuretics seems to be an excellent option to treat acute kidney injury, but, data supporting this are sparse. In fact, possible mischief on part of these agents have been documented. Studies have indicated an increased mortality in critically ill patients with the use of furosemide for acute kidney injury. In large meta-

analysis with patients randomized for the use of high dose diuretics as against of those without it, only a difference in the overall urine output was seen, but, survival stats or the requirement of renal replacement was found to be the same. Higher doses of furosemide is notorious for causing ototoxicity in the form of hearing loss or tinnitus. It can be stated that using the diuretics as a prophylactic agent can in turn precipitate the chance of kidney injury thus questioning the popular practice of bombarding the patients with these agents. They however have an established role in supervision and treatment of hypercalcemia, hyperkalaemia and fluid balance. Mannitol has got several sketchy anecdotal human evidences in its support for being a protective agent for acute renal injury, this however has never been backed by sufficiently strengthened randomized trials which could stand in its support for being designated as an agent responsible for salvaging the kidneys. Mannitol has been supported by some sleek supports that they might be valuable in rhabdomyolysis by activation diuresis by osmotic action, thus reducing the pressure in the compartment of the crushed limbs.13,14,15

Aims and Objectives

There is no study done in eastern Bihar to see the effects of the various resuscitative measures available for the correction of the fluid balance and the effect of diuretics in the acute kidney injury. We did a study to evaluate the number of patients who were admitted in the intensive care unit of Jawaharlal Nehru Medical College and hospital for who developed the acute kidney injury during their stay in the hospital. Further we wish to determine the effect of isotonic crystalloids and colloids in the development of injury and also to ascertain the effect of the use of diuretics in patients with acute kidney injury in improving the outcome or deteriorating it for the referral to the dialyising unit.

METHODS

60 patients admitted in the intensive care unit of our hospital over a period of 6 months were investigated for preexisting renal ailment, those who were found to be free of any such premonitory disease were made to take part in the study. For the resuscitation of the 30 patients IV crystalloids were used and for the rest IV colloids was used. Despite of the preventive measures the 22 patients developed acute kidney injury. These patients with newly developed renal assault were divided further divided into two groups. 11 patients were administered loop diuretics and the rest were not. The patients of each group were evaluated for the need of hemodialysis and mortality.

Inclusion Criteria
Critically ill patients with normally functioning kidneys (creatinine clearance >90mL (mL/min/1.73 m2)).

Exclusion Criteria
Patients who had already existing renal disease, either acute or chronic and those who had fluid overload at the time of admission.

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RESULTS
Of the 60 patients 30 were give IV crystalloids, ringer lactate and the rest 30 IV colloid in the form of albumin. During 1 week or more of stay in the hospital the patients who were given IV albumin were found to be more prone to development of acute kidney injury. 14 patients developed the kidney affection. 8 out of 30 patients who were given ringer lactate developed AKI. Out of these 22 patients with acute kidney injury 11 patients were administered IV furosemide starting with a bolus dose of 200 mg stat followed by a continuous infusion at the rate of 10 mg per hour. These patients were found to have a significant improvement in the urine output. 4 out of these 11 patients required hemodialysis, one opted out of the study and 1 patient succumbed to his illness. Among the other half of the patients 5 patients required hemodialysis and the others improved by re-intensification of their fluid resuscitation.

DISCUSSION
Our study is in coherence with the KDIGO, and we advocate the use of isotonic crystalloids over colloids in patients at risk or with AKI. Hypo-oncotic albumin could have a role in patients who develop sepsis, but this is also negated by the chance of development of infections. Patients with traumatic brain injury should also be spared from the use of albumin. Further, diuretic use was found to be better in patients who developed fluid overload and resulted in potential injury to the lungs and heart. Otherwise, its use was found to be equally useless inspite of an apparent increase in urine output.

CONCLUSIONS
Crystalloids should be used over colloids for the optimal resuscitation of patients admitted for critical care and diuretics should be reserved for patients with fluid overload and not for all the oliguric patients in whom it may create a false sense of renal improvement, by an increase in the urine output.

REFERENCES