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Original Research Article

A prospective study to assess the usage of intravenous fluids in patients presenting to the emergency department

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ABSTRACT

Background: Intravenous (IV) fluid therapy is a common and critical component in the emergency management of patients. However, inappropriate prescribing and management of IV fluids can result in adverse outcomes.
Methods: This was a prospective observational study involving 132 patients who received IV fluids in the ED. The type of IV fluids, indications, infusion rates and the demographic characteristics of patients were recorded and analyzed.
Results: Out of 132 patients, 80 were female and 52 were male. The most frequently used fluid was Normal Saline (NS) (81%). The primary indication for IV fluid administration was hydration (63.50%). Infusion rates were most commonly bolus infusions (86.13%).
Conclusions: The study revealed that the majority of patients were administered IV fluids for hydration, with NS being the most common fluid. Proper education on fluid management in the ED can improve patient safety and treatment outcomes.

Keywords: IV fluids, Emergency department, Fluid therapy, Hydration, Normal saline

INTRODUCTION

Intravenous (IV) fluids are one of the most frequently administered treatments in emergency departments (EDs), used for a variety of indications ranging from simple dehydration to critical resuscitation efforts in septic shock and trauma cases. The choice, volume and rate of fluid administration are crucial decisions that impact patient outcomes.

Despite their widespread use, IV fluids are often mismanaged, leading to complications such as fluid overload, electrolyte imbalances and even increased mortality in some cases. Studies have shown that the inappropriate use of IV fluids can contribute to adverse outcomes, particularly in critically ill patients.[1,2] Normal Saline (NS) and Ringer's Lactate (RL) are the most commonly used crystalloids in clinical practice. However, despite their routine use, there remains considerable debate over the best choice of fluid for different clinical scenarios.[3] Guidelines such as those from the National Institute for Health and Care Excellence (NICE) have sought to provide clarity on the safe use of IV fluids, particularly in terms of indications, appropriate volumes and infusion rates.[4] This study aims to assess the usage patterns of IV fluids in an ED setting, with a focus on fluid type, indications for administration, infusion rates and associated errors.

METHODS

Study type

It was a prospective, observational study.

Study place

The study was conducted at the Emergency Department, Bangalore Baptist Hospital, Bengaluru, Karnataka India.

Study duration

The study period was from June 2023 to November 2023, on patients presented to the emergency department.

Inclusion criteria

Patients who were registered in Bangalore Baptist Hospital, aged between 18-67 years of both sexes, were administered IV fluids in the ED.

Exclusion criteria

Pediatric patients, pregnant women, trauma and animal bite cases were excluded from the study.

A total of 132 patients were selected on the basis of inclusion and exclusion criteria, A patient who was willing to give consent for the study was included and the rest were excluded. Their demographics (age, gender) and parameters (temperature, pulse, resp. rate, bp, spo2, grbs) were collected. The prescription pattern of IV fluids and potentially appropriate and inappropriate use were analyzed.

This method has been used to assess the usage of IV fluids in the emergency department which includes patient records, medical charts and other medical records of the patients. Interviews with medical staff and patient surveys were also used to collect more information and observational methods (patient care and staff activities) were used to assess the usage of IV fluids.

The data include information such as the different types of IV fluids, dosage, volume, dose and flow rate of IV fluids prescribed or administered to the patients in the emergency medicine department. The collected data has been organized and analyzed to compare the IV fluids usage in the emergency department to national standards or guidelines.

The formula for the calculation of IV fluids

Drop factor, IV set drop factor is 20 (Macrodrip set) 20 drops=1 ml. There are Three manners with Dr prescribed fluid. ML/HRS, total volume and total hrs, total volume @ ml/hrs.

Formula for IV set

ML/HRS

Drops/mints = (ml/hr)/3. Example, if 90 ml/hr then how much DPM to be transferred. DPM = 90/3 = 30 dpm

Total volume and total hrs

Ml/hrs = Total volume/Total hrs. Example, 900 ml/6 hrs=150 ml/hr, IV Set = 150/3 =50 dpm

Total volume @ ml/hrs

Total hrs =Total volume/(ml/hrs) Example 1500 ml @ 60 ml/hr**,** total hrs = 1500 ml/60 =25 hrs**,** IV Set = 60/3 = 20 dpm over 25 hrs.

RESULTS

Patient demographics

In this study involving 132 patients, 39% were male (n=52) and 61% were female (n=80). The majority of the patients were in the 28-37 age group (31.06%, n=41), followed by those aged 18-27 years (29.55%, n=39).

Patients in the age range of 38-47 years comprised 20.45% (n=27) of the total, while the remaining participants were distributed between the 48-57 years age group (9.09%, n=12) and 58-67 years age group (9.84%, n=13). These results indicate that a greater proportion of patients in this study were female and primarily between the ages of 18-47, details are depicted in Table 1.

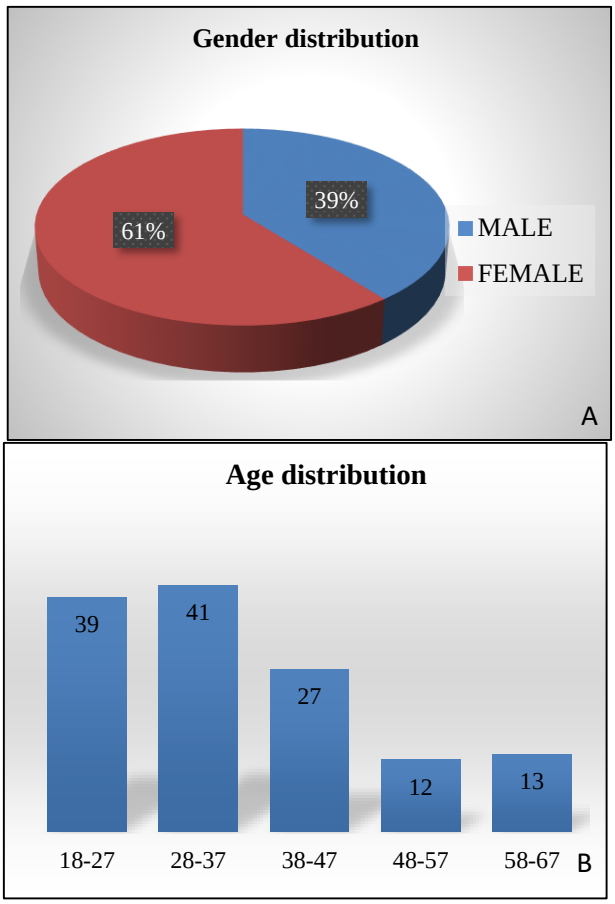

Figure 1 (A and B): Graphical representation of patients based on gender and their age group.

IV fluid types

In the study involving 132 patients, a total of 137 IV fluids were administered. The most commonly used IV fluid was normal saline (NS), which was given to 106 patients (80.30%) accounting for 111 instances of IV fluid use (81%).

Ringer lactate (RL) was administered to 23 patients (17.42%) with 23 uses (17%). Dextrose normal saline (DNS) was given to 2 patients (1.51%) and multivitamin infusion (MVI) was administered to 1 patient (0.75%), representing 1% of the total IV fluid usage for each of these fluids, details are depicted in table 2.

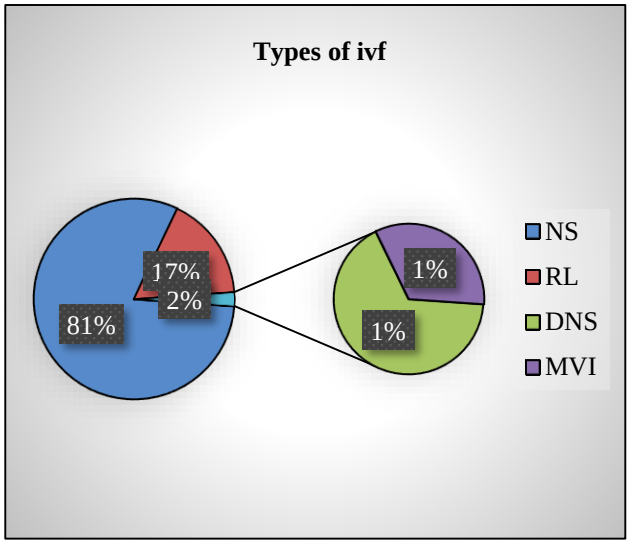

Figure 2: No. of IV Fluids based on types of IV Fluids.

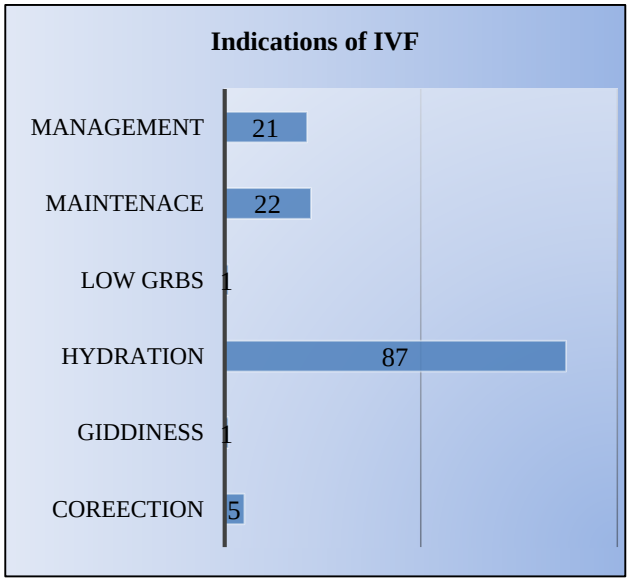

Figure 3: IV Fluids with different indications.

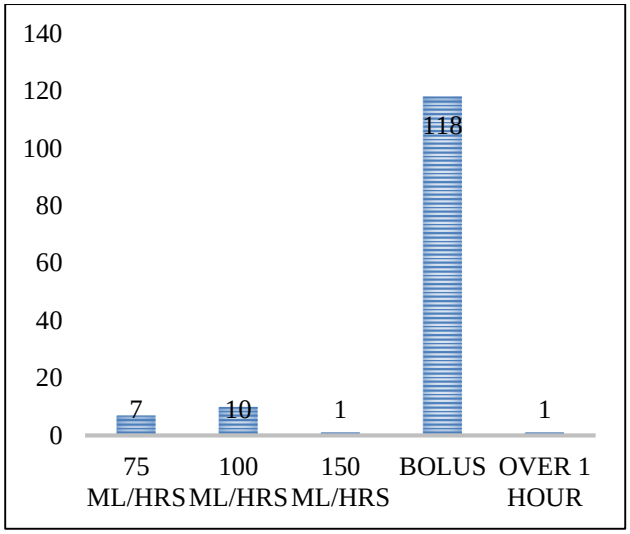

Figure 4: IV Fluids according to their infusion rate.

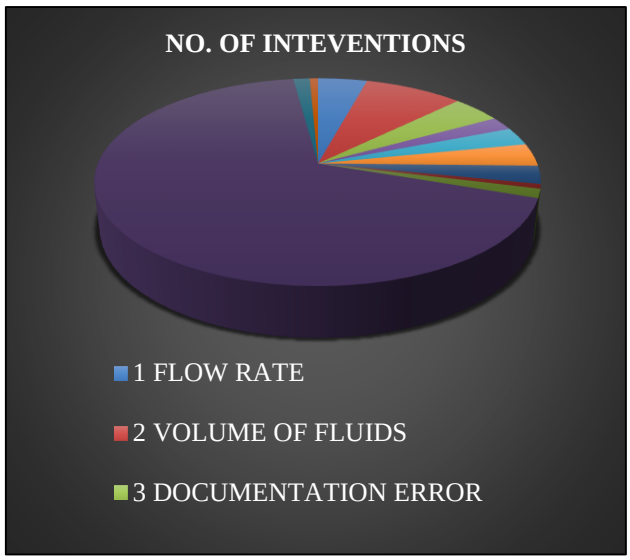

Figure 5: IV Fluids according to their infusion rate.

Indications: In this study, intravenous fluids were administered for various clinical indications. The majority of patients (65.90%, n=87) received IV fluids for hydration, accounting for 63.50% of total fluid usage. IV fluids were also used for maintenance in 14.39% (n=19) of patients, with 16.05% of the fluids allocated for this purpose. Management was the indication for 21.97% (n=21) of patients, corresponding to 15.32% of fluid usage. Fluids were given for correction in 3.78% (n=3) of cases, which represented 3.64% of the total fluids used. Less common indications included giddiness and low GRBS, each affecting 0.75% (n=1) of patients, contributing to 0.72% of fluid usage respectively, details are depicted in table 3.

Infusion Rates and Number of IV Fluids Administered: The assessment of infusion rates for IV fluids among 137 cases shows a predominance of bolus administration, accounting for 86.13% of cases. Lower infusion rates, such

as 75 ml/hr and 100 ml/hr, were observed in 5.10% and 7.29% of cases, respectively. Very few cases involved higher infusion rates (150 ml/hr) or extended durations over one hour, each constituting only 0.72% of the total. The data indicates that bolus administration is the most common practice, with slower infusion rates being less frequent, details are depicted in Table 4.

Quality errors and interventions in IV Fluid Administration: The study observed quality errors and interventions in the administration of intravenous (IV) fluids in the emergency department. Out of 142 cases, 67.60% showed no quality errors. However, the most common issues included errors in the volume of IV fluids (8.45%), documentation errors (4.22%) and flow rate issues (4.22%).

Less frequent errors involved time spacing (2.11%), wrong indications (2.81%) and the omission of flow rate details (2.81%). The study also recorded less common issues like incomplete therapy charts (1.40%), adverse reactions (1.40%) and contraindications (0.70%). Overall, the findings highlight the importance of addressing these quality errors to improve patient care, details are depicted in Table 5.

Table 1: Comparison of demographics data in the study groups.

Category	Subcategory	No. of patients	(%)
Gender distribution	Male	52	39
	Female	80	61
Age group distribution	18-27	39	29.55
	28-37	41	31.06
	38-47	27	20.45
	48-57	12	9.09
	58-67	13	9.84

Table 2: Comparison of types of IV fluid used in the study groups.

Types of fluids	No. of IV fluids	(%)	No. of patients	(%)
NS (normal saline)	111	81	106	80.30
RL (ringer lactate)	23	17	23	17.42
DNS (dextrose normal saline)	2	1	2	1.51
MVI (multivitamin infusion)	1	1	1	0.75
Total	137	100	132	100

Table 3: Comparison of different indications in the study groups.

Indications	No. of patients	(%)	No. of IV fluids	(%)
Correction	3	3.78	5	3.64
Giddiness	1	0.75	1	0.72
Hydration	87	65.90	87	63.50
Low GRBS	1	0.75	1	0.72
Maintenance	19	14.39	22	16.05
Management	21	21.97	21	15.32
Total	132	100	137	100

Table 4: Comparison of infusion rates and number of IV fluids administered in the study groups.

Infusion rate of IV fluids (ml/hr)	Number of IV fluids	(%)
75 ml/hr	7	5.1
100 ml/hr	9	7.29
150 ml/hr	1	0.72
Bolus	116	86.13
Over 1 hour	1	0.72
Total	134	100

Table 5: Comparison of quality errors and interventions in IV fluid administration for the study groups.

Quality error observed	Number of interventions	(%)
Flow rate	6	4.22
Volume of IV fluids	12	8.45
Documentation error	6	4.22
Time Spacing	3	2.11
Wrong indication	4	2.81
Mentioned multiple IV fluids	5	3.52
not mentioned flow rate	4	2.81
Diagnosis	1	0.7
Incomplete therapy chart	2	1.4
No quality error	96	67.6
Adverse reactions (ADRs)	2	1.4
Contraindications	1	0.7
Total	142	100

DISCUSSION

The findings of this study reveal a heavy reliance on Normal Saline (NS), which accounted for 81% of the fluids administered. This is consistent with previous studies that have shown NS to be the preferred choice for hydration and fluid resuscitation due to its isotonic properties and widespread availability.[5] However, there is growing evidence suggesting that the excessive use of NS, particularly in large volumes, can lead to hyperchloremic acidosis, a condition that has been associated with worse outcomes in critically ill patients.[6]

Our study found that NS was primarily used for hydration (63.50% of cases), which is in line with the general practice, but underscores the need for cautious administration in specific patient populations, such as those with renal impairment or sepsis. In comparison, Ringer's Lactate (RL) was used in 17% of the cases, a fluid that is often preferred in surgical and trauma patients due to its balanced electrolyte composition and its ability to correct metabolic acidosis.[7] Studies have demonstrated the benefits of RL over NS in terms of preventing acidosis, but it is less commonly used in the ED due to concerns about hyperkalemia and lactate metabolism in patients with liver dysfunction.[8]

Despite these concerns, RL is recommended in many guidelines for fluid resuscitation in trauma and burn patients.[9] The high percentage of bolus infusions (86.13%) observed in this study highlights the ED's focus on rapid fluid administration, which is necessary in acute resuscitation settings.[10] However, rapid administration of large fluid volumes can lead to complications such as fluid overload, particularly in patients with heart failure or renal dysfunction.[11] Recent research has emphasized the importance of individualized fluid management, advocating for conservative fluid administration strategies, particularly in septic patients.[12] In our study, errors related to fluid volume (12 cases) and infusion rate (6 cases) further underline the challenges of maintaining precision in a fast-paced ED environment. The inappropriate use of IV fluids, identified in cases where volume or rate was incorrect, mirrors findings from other studies that have shown significant rates of fluid mismanagement in hospital settings.[13] For example, a study by Gao et al, found that 74% of patients receiving IV potassium could have been treated with oral potassium, demonstrating the frequent over-reliance on IV therapy when oral alternatives might suffice.[14] When comparing these findings with other major studies published in high-impact journals, such as those on fluid therapy in septic shock, it becomes clear that balanced solutions like RL are increasingly favored in critical care settings.

The SMART trial, published in The New England Journal of Medicine, concluded that balanced crystalloids reduced the incidence of major adverse kidney events compared to NS in critically ill patients.[15] Additionally, the SPLIT trial, also published in a leading journal, found that the use of balanced crystalloids led to better patient outcomes in ICU settings without increasing the risk of hyperkalemia or metabolic alkalosis.[16]

In summary, this study provides valuable insights into the real-world usage of IV fluids in a tertiary care ED and highlights areas for improvement. The predominant use of NS, combined with the frequent administration of bolus infusions, reflects standard emergency practices but also underscores the potential for adverse outcomes due to fluid mismanagement. Continued education, adherence to guidelines and ongoing audits are essential to improving the safe and effective use of IV fluids.

This study has several limitations. Firstly, it was conducted over a relatively short period of six months, which may limit the generalizability of the findings over a longer period. Additionally, the study was conducted in a single tertiary care hospital and results may not be reflective of practices in other regions or hospitals with different patient demographics. The study excluded pediatric, trauma and pregnant patients, which limits the findings' scope.

Furthermore, errors in fluid administration were observed, but the study did not assess the long-term outcomes of these errors. Finally, the study did not include a detailed assessment of the appropriateness of IV fluid selection based on patient comorbidities, which could influence fluid management decisions.

CONCLUSION

This study highlights the predominant use of Normal Saline for hydration in emergency department patients, with bolus administration being the most common infusion method. While most fluid administrations were appropriate, errors in volume and infusion rates were identified, underscoring the need for continuous education and protocol adherence. Pharmacists can play a key role in minimizing such errors by ensuring proper fluid selection and dosage, promoting guideline adherence and contributing to patient safety through active involvement in reviewing and managing IV fluid therapies. Improving interprofessional collaboration in fluid management can lead to better clinical outcomes in emergency care.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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