CURRENT TREND OF INTRAVENOUS FLUID USE IN MEDICINE WARDS IN A TEACHING HOSPITAL

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Abstract

Background: Some hospitalized patients may not be able to eat and drink and often have depleted fluid levels and electrolyte imbalance. So, intravenous (IV) fluid therapy is a part of everyday clinical practice. Aims: This study was carried out to assess the extent of rational use of IV fluid in indoor patients of medicine wards of Chittagong Medical College Hospital (CMCH). **Materials and methods:** This cross sectional observational study was done in CMCH from April to November 2014. One hundred and ninety four (n=194) patients getting IV fluid were selected by purposive sampling. All relevant information for each study subject was collected by 'Observing Method' using a data collection sheet after getting informed written consent. Variables were checked. Results were matched with standard guidelines. **Results:** Male patients were 1.3 times more than female. Acute abdomen (20.62%) Acute febrile illness (11.85%) Poisoning (11.34%) Stroke (10.31%) and Acute watery diarrhea (9.28%) were common indications for giving IV fluid. Status of hydration was properly assessed in 82.99% patients. Commonly used fluids were 5% DNS (34.02%) NS (17.01%) CS (7.22%). Amount of fluid was appropriate in 90.20% patients but constituents were appropriate only in 52.06% patients. Most of the patients (76%) had received IV fluid for one day. Thirteen (6.70%) patients had suffered from IV fluid related complications. **Conclusion:** Considering assessment of status of hydration, amount and constituents of fluid, 64 (33%) patients had received IV fluid in a rational way. This study highlights the importance of multicentre study to formulate a national guideline.

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Key words

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Introduction

In the average young adult male, 60% of the body weight is water. The intracellular component of body water accounts for about 40% of body weight and the extracellular component for about 20%. The cells that make up the body exist in an 'internal sea' of interstitial component of Extracellular Fluid (ECF). From ECF, cells take up oxygen and nutrients and discharge metabolic waste products[1].

Normally body fluid losses occur by 4 routes. Loss by skin (600-1000ml/day) and lungs (400 ml/day) are 'insensible' loss. Fluid loss through urine (1500 ml/day) and faces (60-100ml/day) are 'obligatory' loss. These daily loss (e.g. about 3 Liters) are daily maintenance requirements[2].

Daily maintenance requirement for water is 35-45ml/kg body weight. Daily Sodium requirement is 1.5-2 mmol/kg and Potassium requirement is 1-1.5 mmol/kg. For a typical 70 kg adult daily maintenance requirement of water is 2.5-3L, Sodium100-140 mmol and Potassium 70-100 mmol[3].

In health, the volume and biochemical composition of both the extracellular and intracellular fluid compartments in the body remains remarkably constant. Many different disease states result in changes of control, either of extracellular fluid volume or of the electrolyte composition of extracellular fluid[4].

Therefore intravenous fluid therapy is part of everyday clinical practice in many fields of medicine[5].

IV fluid therapy is given for pre-existing loss ('replacement' fluid), insensible plus obligatory loss ('maintenance' fluid) and to compensate for anticipated additional intestinal or other losses ('Supplemental fluid')[2].

There are two types of fluids that are used for intravenous drips: crystalloids and colloids[6].

The choice of fluid and the volume and the rate of administration depend on the clinical circumstances, as assessed at the bedside and from laboratory data in a stepwise manner. In bedside assessment of clinical volume status (Step-1) reviewing fluid balance chart (Step-2), assessment of ongoing pathological process (Step-3) should be considered. Laboratory tests as S.electrolytes, blood urea, S.creatinine should be checked (Step-4)[3].

Weight loss or gain is the best indication of water balance. Insensible water loss should be further considered in febrile patient. Water loss increases by 100-150 ml/day for each 1 degree (1^0) rise of body temperature over 37^o C[7].

Correct fluid and electrolyte balance is essential to maintain normal physiological function. Hospitalized patients may not be able to eat and drink normally and often have depleted fluid levels and or an electrolyte imbalance. IV fluid is therefore often needed to restore or maintain balance[8].

In general, there are several types of medical patients who come to administer IV fluid for various reasons, The hypovolemic patient (most common eg. sepsis, intractable nausea/vomiting, etc), the hypervolemic patient (eg. congestive heart failure, cardiac shock, cirrhosis, renal failure, fluid overload etc) and the patient here for an elective reason (Expedited work-up of possible malignancy, etc)[9].

There are many issues to consider when prescribing IV fluid and electrolytes. Inadequate fluid can lead to hypovolemia and poor organ perfusion and excessive fluid result in edema and compromised tissue oxygenation, impairment of coagulation, delayed recovery of gastrointestinal motility and increased risk of cardiac complications[8,10].

Under or over perfusion of electrolytes can also lead to potentially serious disturbance of electrolyte balance (e.g. confusion, delirium, convulsion, cardiac arrhythmia, acidosis etc) particularly in patients with impaired kidney or liver function[8].

In hypovolemic patients the fluid of choice is Normal Saline (NS). If more than 3-4 liters of normal saline is required then it needs to switch over to lactated Ringer's Solution (LR) because of the risk of 'expansion acidosis'. In hypervolemic patients fluids should be avoided at any costs. If the patient is on Nothing Per Orally (NPO) for longer than 6-12 hours, administration of 5% dextrose in normal saline (5% DNS) at 75-100 ml/hour is needed. The reason for giving Dextrose (D) is to prevent catabolism. In medical patients, the rate is somewhat arbitrary and physicians have to use their own judgment. For resuscitation, fluids are given 'wide open' or at the rate of 500 ml/hr[9]. If IV fluids are the only source of water, electrolytes and calories for longer than a week, more complex fluids containing amino acids, lipids, trace metals, phosphorus and vitamins may be indicated[7].

In current practice it is noted that prescribers are not always aware of the specific constituents of the various IV fluids because of lack of formal training and education. In IV fluid management, monitoring of the patients are often suboptimal, fluid and electrolytes status is not being recorded accurately and changes in patient's requirements are often not assessed[8.]

It is widely accepted that the errors in prescribing fluid leading to insufficient or excessive perfusion of IV fluid are common and have adverse effects on patient's morbidity and mortality. These errors are particularly likely to arise in acute admission unit and general wards where prescription and initiation of IV fluid are undertaken by less experienced staffs[8].

There is a need for a standardized approach to the clinical assessment of patient's fluid and electrolyte status and choose a proper IV fluid therapy in medicine wards of a teaching hospital.

This study was carried out to assess the current practice and rationality of intravenous fluid use in medicine wards in a teaching hospital.

General objective was to assess the extent of rational use of IV fluid in the medicine wards of a teaching hospital. Specific objectives were to check indication, types, amount, and rate of IV fluid administration, to see whether status of hydration was recorded before IV fluid administration to note whether lab investigations (Blood urea, S. creatinine, S. electrolytes) have been done before, during or after IV fluid administration specially in hypovolemic patient and complications (eg.oedema, extravasation, skin necrosis, thrombophlebitis etc.) of IV fluid administration.

Materials and methods

This cross sectional observational study was carried out in the Department of Medicine of Chittagong Medical College Hospital among the indoor patients receiving IV fluids from April 2014 to November 2014. This study was a dissertation work for FCPS (Medicine) and was approved by Bangladesh College of Physicians and Surgeons. Total 197 patients were taken for the study but 3 patients had died during the study period. So sample size was 194 (n=194). Pregnant woman, patients needing inotropes to support their circulation, blood and blood products were excluded from this study. Patients were selected after taking proper informed written consent. Primary diagnosis of the patient, hydration status, indication for the IV fluid used and amount of fluid used with its composition were noted till discontinuation of IV fluid. Whether IV fluid was given to a Nothing Per Oral (NPO) patient or patients having oral feeding were also considered. Complications of fluid used and cost were recorded. Whether laboratory investigations were done or not had been recorded. All relevant information for each individual study subject was collected by 'Observing Method' using a data collection sheet. Collected data were checked and verified. Variables were identified. Results are shown as frequency and percentage. Results were matched with a standard available guideline.

Results

Table I : Primary diagnosis of admitted patient where IV fluid were used (n=194)

Diagnosis	Number	Percentage (%)
Acute abdomen	40	20.62%
PUD	05	
Acute pancreatitis	09	
Acute cholecystitis	05	
Acute intestinal obstruction	13	
Abdominal TB	08	
Acute febrile illness	23	11.85%
Poisoning	22	11.34%
Stroke	20	10.31%
Acute watery diarrhea	18	9.28%
Snake bite	16	8.23%
Oncology	13	6.70%
Functional disorder	10	5.15%
Insect bite	09	4.64%
Urosepsis	07	3.60%
CLD	06	3.09%
Others	10	5.15%

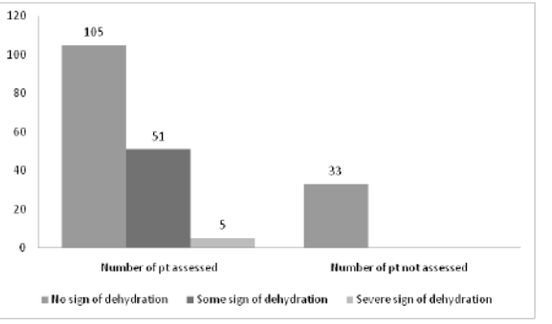

Fig 1 : Hydration status of patients before giving IV fluid. (n=194)

Table II : Types of IV fluid used (n=194)

Types	Number	Percentage (%)
5% Dextrose in normal saline (5% DNS)	66	34.02%
Normal saline (NS)	33	17.01%
Cholera saline (CS)	14	7.22%
5% Dextrose in aqua (5% DA)	04	2.04%
Hartmans' solution	03	1.55%
Combination	74	38.14%
5% DA + 5% DNS	55	28.35%
NS + CS	06	3.09%
NS + 5% DNS	13	6.70%

Table-III : Types and amount of IV fluid according to purpose (n=194)

Purpose of IV fluid use	Types of IV fluid and Amount (ml/hr)	Number (Percentage %)
A) Replacement		8 (4.12 %)
	CS 1L (500ml/hr)	2
	CS 1L (200 ml/hr)	4
	5%DA 1/2 L+ 5% DNS 1L (100 ml/hr)	2
B) Maintenance		133 (68.55%)
In NPO		46
	5% DNS 2L+ 5% DA 1L (125ml/hr)	30
	5% DNS 2L (83 ml/ hr)	11
	5% DNS 1L+ NS 1L (83 ml/hr)	05
With enteral feed		87
	NS 1L (42 ml/hr)	39
	5% DNS 1L (42ml/hr)	36
	5% DA 1/2 L+ 5% DNS1/2L (42ml/hr)	7
	5% DA 1 L (42ml/hr)	5
C) Both maintenance and replacement		53 (27.32%)
In NPO		45
	5% DNS 2L+ 5% DA 1L (125ml/hr)	27
	5% DNS 2L (83 ml/ hr)	9
	5% DNS 1L+ NS 1L (83 ml/hr)	5
	5% DNS 1L+ HS 1L (83ml/hr)	4
With enteral feed		8
	CS 1L (42 ml/hr)	3
	5% DNS 1L (42ml/hr)	2
	5% DA 1/2 L+ 5% DNS1L (62 ml/hr)	2
	5% DA 1 L (42ml/hr)	1

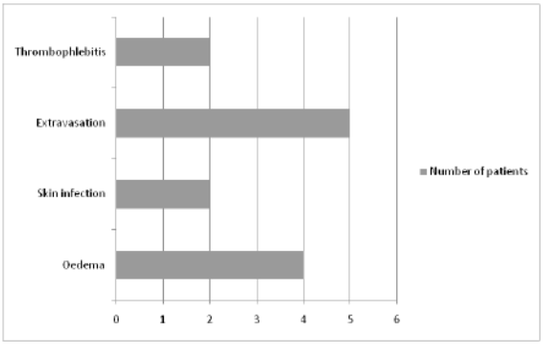

Fig 2 : Complications faced during IV fluid administration (n=194)

Male patients were 110 and female 84. Male patients underwent intravenous fluid are 1.3 times more than female. Mean age of the studied male were 43.73 years and that of female were 42.15 years. Median age for male was 45 years and female was 40 years.

Males are mostly service holder 30 (27.27%) Farmer 23 (21%) but female are mostly housewife 69 (82.14%).Ninety nine (51.03%) patients have income source and most (53, 53.53%) have monthly income between 5000-10000 Taka. Ninety five (48.97%) patients have no income source and they are dependent to their family.

Table I shows conditions where IV fluids were used. Among this, Acute abdomen (40, 20.62%) Acute febrile illness (23, 11.85%) Poisoning (22, 11.34%) Stroke (20, 10.31%) Acute watery diarrhea (18, 9.28%) comprises maximum bulk.

Status of hydration were properly assessed in 161(82.99%) patients, but in 33 patients (17.01%) IV fluid was infused without prior assessment (Fig 1).

Table II shows almost all available fluids were used. Commonly used fluids were 5% DNS (34.02%) NS (17.01%) CS (7.22%). Combination of fluids used in 38.14% cases and commonest combination is 5% DA with 5% DNS (28.35%).

Eight (8) patients had received IV fluid for replacement purpose, 2 patients (25%) had received at 500 ml per hour and 6 patients received CS. Among 46 NPO patients receiving maintenance fluid, 30 patients received 5% DNS 2 L+ 5% DA 1L @ 125ml/hr and most patients who were on enteral feed received NS or 5%DNS at 42ml/hr. 53 Patients had received fluid for both replacement and maintenance purpose almost same as used for maintenance (Table III).

Out of 56 hypovolemic patients in 40 cases Serum creatinine and Serum electrolytes were done.

Blood urea estimation was not carried out in any patient. 76% patients had received IV fluid for one day and 18% patients received it for 2 days. Only 6% patient received IV fluid more than 2 days.

One hundred and forty seven (147) patients (76%) received IV fluid for 1 day, 35 patients (18%) for 2days, 8 patients (4%) for 2days and 4 patients (2%) for 4days,

IV fluid related Complications were noted in 13 (6.70%) patients, among them Extravasation 5 (38.46%) Oedema 4 (30.77%) Skin infection 2 (15.38%) Thrombophlebitis 2 (15.38%) were common (Fig 2).

Cost for IV fluid used had ranged from 200 Taka to 2000 Taka with an average expenditure of 700 Taka per patient.

Discussion

In the average young adult male, Intracellular component (ICF) of body water accounts for about 40% of body weight and the Extracellular component (ECF) for about 20%. From ECF, cells take up oxygen and nutrients and discharge metabolic waste products[1]. For a typical 70 kg adult daily maintenance requirement of water is 2.5-3L, Sodium100-140 mmol and Potassium 70-100 mmol[3]. Many different disease states result in changes of control, either of ECF volume or of the electrolyte composition of extracellular fluid[4]. Therefore intravenous fluid therapy is part of everyday clinical practice in many fields of medicine[5]. The present study was carried out between April 2014 to November 2014 in Chittagong Medical College Hospital, Chittagong, Bangladesh. One hundred and ninety four (n=194) patients admitted in medicine wards having Intravenous (IV) fluid were studied as per inclusion criteria. This study had evaluated overall practice of IV fluid in medicine wards in various clinical conditions. The main aim of the study was to assess the current trend of intravenous fluid use and its rationality in medicine wards in a teaching hospital.

The study topic is clinically relevant and important because errors in prescribing fluid leading to insufficient or excessive perfusion are common and have adverse effects on patients.

In this study, male patients were 110 (56.70%) and female patients were 84 (43.30%) with a male female ratio1.3:1.

Age of the patients in this study was between 12 years to 82 years in case of male and 14 years to 90 years in female. Most of the patients were in 11-30 years of age group (70.53%) in which male was 33.63% and female was 36.90%.

This study had showed that male are mostly service holder (27.27%) and farmer (21%) but female are mostly housewife (82.14%). Only 51.03% patients have income source and most (53.53%) have monthly income between 5000-10000 Taka.

In this study it was noted that acute abdomen is the commonest (20.62%) condition where IV fluid was used. Next common conditions were Acute febrile illness (11.85%) Poisoning (11.34%) Stroke (10.31%) and Acute watery diarrhea (9.28%). But in 36 (18.56%) cases (e.g. insect bite, functional disorders) unnecessary IV fluid had been administered. Clinical conditions where IV fluids were used in this study are almost similar as recommended in NICE and National clearing guideline center[11,8].

In this study, before giving IV fluid, status of hydration were properly assessed in 161(82.99%) patients, but in 33 patients (17.01%) IV fluid was infused without prior assessment, but with NICE guideline recommends to assess patients' fluid and electrolyte needs as part of every ward review[11]. Among 161 patients, IV fluids were infused in 105 patients without any signs of dehydration, though it is rational as NICE guideline's recommendation is that patients who cannot meet their daily needs of fluids and electrolytes through oral or enteral routes but are otherwise euvolaemic often need IV fluid therapy for maintenance[11].

Out of 56 hypovolemic patients, Serum creatinine and Serum electrolytes were estimated in 40 (71.43%) cases. Blood urea were not estimated in any patient but both NICE and BCGIF guidelines recommend to do blood urea, serum creatinine and serum electrolytes in every hypovolemic patients who are going to receive IV fluid[11,12].

Commonly used IV fluids documented in this study were- 5%DNS (34.02%) NS (17.01%) CS (7.22%) and combination of different fluids (38.14%) but BCGIF recommended fluids are 5% DA, 0.18% NS with 5%DA, 0.45% NS, HS and Ringer's lactate solution[12].

In the present study 76% patients had received IV fluid for one day and 18% patients received it for 2 days. Only 6% patient received IV fluid more than 2 days.

One hundred and thirty three (133) patients (68.55%) had received IV infusion as maintenance fluid. Only in 8 patients (4.12%) it was used as replacement fluid. Fifty three (27.32%) patients received both replacement and maintenance infusion. This data signifies that IV infusion is more or less based on patient's clinical conditions.

Eight patients had infused IV fluid for replacement purpose while only in 2 patients (25%) it was appropriate regarding amount and constituents. In the rest 6 patients (75%) 100-200 ml replacement fluid were given per hour. Six patients received CS as replacement fluid, rest 2 patients got 5%DA with 5%DNS whereas NICE guideline recommends to use crystalloids that contain sodium in the range 130–154 mmol/l as replacement fluid with a bolus of 500 ml over less than a hour[11].

One hundred and thirty three (133) patients received maintenance fluid. Out of them 46 NPO patients received 83-125 ml fluid per hour whereas 87 patients with enteral feed had received fluid at a rate of 42 ml per hour. Among NPO patients, 30 patients received 2 L of 5% DNS and 1L of 5% DA, 11 patients received 2L of 5% DNS and 5 patients received 1 L of 5% DNS with NS 1 L. Among 87 patients on enteral feeding 39 patients received NS 1L, 36 patients received 5% DNS 1L, 7 patients received 5% DA 500 ml with 5% DNS 1L and 5 patients received 5% DA 1 L per day. NICE and BCGIF guideline recommends 0.18% NaCl with 4% dextrose (Along with 70 mmol K^+/day) 1.5- 2.5 L/day as maintenance fluid[15,13]. So in the present study, amount of fluid was appropriate in 128 (96.24%) patients and in 5 (3.76%) patients the amount was less if we consider our tropical climate. In all NPO patients receiving IV maintenance fluid, constituents of fluid was not appropriate as per recommendation.

In this study 53 patients had received IV fluid for both replacement and maintenance purpose. Out of them 45 patients were on NPO and 8 patients were on enteral feed. NPO patients received fluid at 83-125 ml per hour and commonest fluid was 5% DNS 2 L and 5% DA 1L where amount was adequate but constituents were inappropriate as per NICE guideline[11]. Patients on enteral feeding received different fluid like CS, 5% DNS and 5% DA at a rate of 42-63 ml/hour but it is difficult to comment on rationality as oral fluid intake were not assessed in such patients.

Out of 194 patients proper assessment was done in 161 patients. Fluid infusion was not rational either in amount or constituents in 97 patients (6 patients having fluid for replacement plus 46 NPO patients with maintenance plus 45 NPO patients with both replacement and maintenance). If we add 33 patients that had IV fluid without any assessment with 97, total number of patients having fluid irrationally will be 130 (67%). So fluid was used rationally in 64 (33%) patients (97 deducted from 161 or 130 deducted from 194).

Most of the patients (147, 76%) received IV fluid for 1 day. IV fluid related complications were noted in 13 (6.70%) patients; among them extravasation (38.46%), oedema (30.77%) were common but NICE guideline documented hypovolemia, pulmonary edema and electrolyte disturbances as consequences of fluid mismanagement[11].

Expenditure for IV fluid used ranged 200 Taka to 2000 Taka with an average expenditure of 700 Taka per patient so inappropriate use of IV fluid is a burden to the patient.

Limitation of the study

1. Single center study.
2. This study only notes the current trend of IV fluid use but did not compare it with a standard control group.

Conclusion

It is suggested to assess status of hydration, choose correct type and amount of fluid as per indication before administration. Periodic and meticulous follow up is needed to avoid complications. The result of the present study highlights the importance of multicentre large scale study having a control group to formulate a national guideline.

Disclosure

All the authors declare no competing interest.

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