

**ORIGINAL ARTICLE**

**Postoperative Fluid Management in Emergency Abdominal Surgery in Omdurman Teaching Hospital**

Omer Elgorashi Abdelrahim Elbashier<sup>1</sup>, Aamir Abdullahi Hamza<sup>2</sup>

1. MBBS, Senior registrar of G. Surgery SMSB, MRCS Edinburgh, e.mail: omarg2002@hotmail.com
2. MD, MD (SMSB) Hon, FCS (ECSA), Dept. of General surgery, Bahri University, Khartoum, Sudan, aamirhamzza@yahoo.co.uk

**Abstract:**

**Background:** Postoperative intra-venous (IV) fluid management is still challenging, and despite many well-established guidelines, there are defects in IV fluid therapy. Many studies have shown that mal practice is not uncommon. An individualized approach in choosing types and amounts of IV fluid that meet the patient's needs, is being advocated. Complications of IV fluid management are common, and might be life-threatening, causes are: mismanagement, mal documentation and poor assessment.

**Objectives:** In this study, we reported the postoperative fluid management in emergency laparotomy at Omdurman teaching hospital

**Patients and methods:** This cross-sectional prospective study included 87 patients. All patients with emergency laparotomy who received postoperative IV fluids, in Omdurman teaching hospital, between April 2018 and March 2019 were enrolled.

**Results:** Age of patients range from 18 to 78 years. Males; 69 (79.3%) and females; 18 (20.7%). Most common cause for emergency laparotomy was penetrating abdominal trauma (36.8%), peritonitis (25.3%), Intestinal obstruction (21.8%), and blunt abdominal trauma (16.1%). Minimum amount given was 3 liters, and maximum amount was 6 liters. The most common type used is D5%, RL, DNS then NS. There were no weight measurements and fluids were seldom given in relation to weight or age. Overload occurred in (43%) of patients, under-hydration in (61%) of patients and electrolyte imbalance in (42.5%) of patients. Hypernatraemia developed in (27.6%) patients, and was related to overprescribing of high doses of saline-contained fluids (>250mmol/day) in about (87.5%) of

patients. Fluid overload was related significantly to hypernatraemia. Hypokalaemia developed in (14.9%) of patients which was related to lack of potassium supplementation in all cases.

**Conclusion:** Malpractice of postoperative fluid management was common in patients who underwent emergency laparotomy in Omdurmanteaching hospital. Simple interventions might be introduced to improve outcomes such as training and education in this domain.

**Key words** assessment of body fluids, complications, electrolyte disturbance, IV fluids, overload, postoperative management, under-hydration.

### **Introduction:**

Intravenous (IV) fluid therapy has been used since 1832.<sup>(1)</sup> In surgical care. IV fluid management is a basic component, especially in patients who undergo major operation. Postoperative fluid management aims to deliver adequate maintenance of fluid and electrolytes to meet the body's needs. There is significant variation in postoperative fluid prescription. Types, amount and timing of IV fluids administration are the main factors that determine management strategy and influence patients' outcome. An optimum dose of intravenous fluids remains controversial with no definitive evidence to support restrictive versus liberal approaches. National Confidential Enquiry into Perioperative Deaths, recommended that up to one in five patients receiving IV fluids in hospital suffered a degree of morbidity due to inappropriate prescription or administration, and patients who had received inappropriate or excessive IV fluids in postoperative period had a higher post-operative mortality.<sup>(2,3)</sup> Simple assessment parameters such as BP, PR and urine output, can guide optimal management.<sup>(4)</sup> Inadequate care and poor understanding of the principles lead to adverse events in surgical patients.<sup>(5)</sup> Under-hydration causes hypotension, tissue hypoperfusion, systemic inflammatory response syndrome, sepsis, and multiple organ dysfunction. Whereas over-hydration lead to oedema, ileus, respiratory and cardiac complications.<sup>(6)</sup> It also prolongs hospital stays.<sup>(7)</sup>

### **Patients and Methods**

The study was descriptive, prospective and hospital- based, was carried at Omdurman teaching hospital, Khartoum, Sudan. It was conducted over one year from April 2018 to March 2019. Any adult patient who underwent emergency laparotomy and received postoperative IV fluid was included in the study. Non-probability sampling technique was used; data were collected using a pre-designed and pre tested questionnaire; the variables include general demographic data, body weight, co-morbidities, vital signs, investigations, surgical findings, modalities of postoperative IV fluid and electrolytes management, assessment methods and postoperative consequences. Data were analyzed using SPSS v22; and the P value was considered significant if less than 0.05. Consent obtained from all patients with ethical clearance.

### **Results**

Eighty-seven patients were included in this study; The mean age was 37.2 years, with a range of (18 to 78 years), and were 69 (79.3%) males and 18 (20.7%) females, with a ratio of M: F (26:1). Common ages affected were those from 18 to 35 years old, accounting for 49 (56.3%) patients.

The most common cause for emergency laparotomy was penetrating abdominal trauma accounting for 32 (36.8%) patients, then, peritonitis; 22 (25.3%), Intestinal obstruction; 19 (21.8%), and blunt abdominal trauma; 14 (16.1%). Twenty-eight (32.3%) had mesenteric injury and /or bowel injury, 13 (14.9%) had volvulus, 13 (14.9%) had perforated DU/viscus, 18 (20.6%) had solid organ injury (liver/spleen/kidney), nine (10.4%) had perforated appendix, and six (6.9%) had obstructing tumour.

#### **Types and amounts of IV fluid prescribed:**

The minimum amount of IV fluid given was three litres in twenty-one (24.1%) patients, that has been considered as restrictive approach, while most of patients sixty-six (75.9%) received more than three litres, and were considered as liberal approach.

The most common type of IV fluid prescribed in the postoperative days was dextrose 5% (50%), followed by Ringer lactate(21%). Dextrose 5% with normal saline 0.9% (18%) and normal saline 0.9%(11%). (Table 1)

#### **Assessment methods:**

As observed from follow up sheets were very incomplete. The author has noticed inadequate vital signs assessment. There were no documentation of BP and

temperature follow-up. Assessment tools used were vital signs that were only noticed in 26 (29.9%) patients, fluid charts in 24 (27.6%) patients, added laboratory tests in 22 (25.3%) patients, and intensive follow-up observed in patients admitted to high dependency-care unit who were two (2.3%) patients. A decrease in blood pressure and an increase in pulse rate were noticed in about nine (69.2%) oliguric patients, reflecting hypovolemia.

**Table 1: The percentage of the doses of different IV fluid types given in postoperative period and the total percentage of prescription for each type**

Doses of IV fluid (ml)	Frequency and types of IV fluids				Total
	D 5%	NS 0.9%	RL	DNS	
1500	01.0%	4.2%	20%	01%	26.2%
3000	35.0%	3.0%	01%	12%	51.0%
4000	00.5%	0.2%	0	01%	01.7%
4500	13.5%	3.6%	0	04%	21.1%
<b>Total</b>	<b>50%</b>	<b>11%</b>	<b>21%</b>	<b>18%</b>	<b>100%</b>

The correlation of IV fluid amounts to body weight was insignificant in terms of P value 0.3, as well as the correlation to age, with P value 0.6. There was one patient and two patients who weighs tea (66 – 75 and 76 – 85 Kg) respectively, had received more than five litres, contrariwise, 17 (19.5%) patients who weighs tea more than (76 Kg) had received less than three litres. On the other hand, another 17 (19.5%) young patients aging (8 – 35 years), had received less than three litres and three (3.4%) of them received more than five litres, again contrariwise, six (6.9%) of elderly patients received more than four litres. (Table 2,3)

**Table 2: Percentage of the amounts of IV fluids given per day over the postoperative period\* in relation to weight**

Body weight (Kg)	Amounts of fluid (ml)			
	2500-3000	3100-4000	4100-5000	>5000
55 – 65	08%	0	6%	0
66 – 75	12%	7%	14%	1%
76 – 85	15%	8%	17%	2%
> 85	04%	1%	05%	0

\*Median amount of IV fluids in the postoperative days.

***P value 0.3, Pearsons' r = -0.02***

**Table 3: Percentage of the amounts of IV fluids given per day over the postoperative period\* in relation to age**

Age group (years)	Amounts of fluid (ml)			
	2500-3000	3100-4000	4100-5000	>5000
18 – 35	21%	2%	27%	3%
36 – 55	14%	5%	14%	1%
56 – 80	05%	1%	07%	0

\*Median amount of IV fluids in the postoperative days.

***P value 0.6, and Pearsons’ r = -0.03***

**Complications of IV fluid administration:**

Thirteen patients (14.9%) were oliguric, of whom three patients developed renal impairment and all of these cases (100%) were under-hydrated; (<3litre/day). Eight (9.2%) patients developed generalized oedema, (89%) of them were overloaded; (>4litre/day). Among all patients who were overloaded, 16 (64%) were having hypernatraemia, P value 0.03. (Table 4)

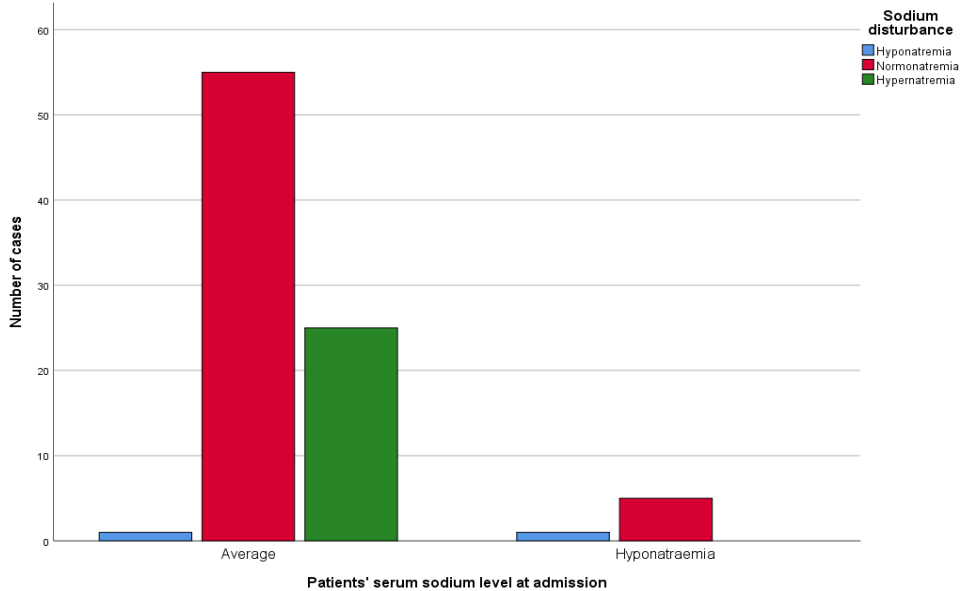
**Table 4: Percentage of postoperative IV fluid complications in relation to liberal and restrictive approaches in the study**

IV fluid approach	Postoperative Morbidity			Complications of IV fluids			Total
	Paralytic ileus	Surgical-site infection	Sepsis	Oliguria	Renal impairment	Generalized oedema	
Restrictive	4.6%	3.4%	2.3%	11.5%	3.4%	0	25.2%
Liberal	9.2%	5.7%	1.1%	0	0	8%	24.0%

***P value 0.01, and Pearsons’ r = 0.736***

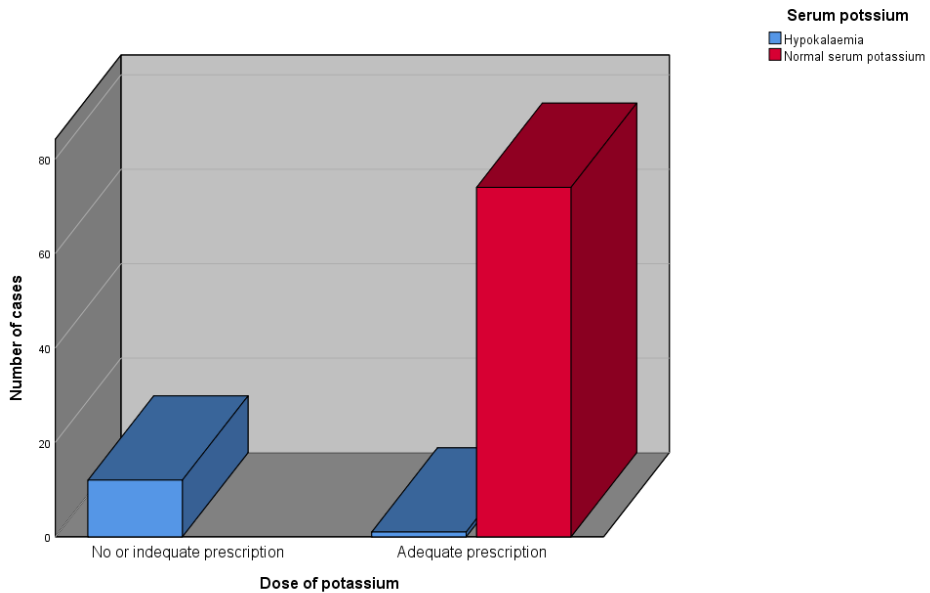
**Electrolytes disturbance:**

Thirty-seven patients (42.5%) had suffered from electrolyte imbalance. Hypernatraemia developed in 24 (27.6%) patients, and was related to over-prescription of high doses of saline-contained fluids (>250mmol/day) in about (87.5%) of patients.No patient had hypernatraemia at admission. (Figure 1)



**Figure 1: Sodium level at admission related the sodium disturbance**

Hypokalaemia noticed in 13 (14.9%) patients, which was related to lack of potassium supplementation in all cases, P value 0.01. Two patients of peritonitis were having hypokalaemia and was corrected. (Figure 2)



**Figure 2: Potassium imbalance in correspondence to prescription**  
*P value 0.01, Pearsons' r = 0.639*

Paralytic ileus occurred in twelve (13.8%) patients, followed by surgical site infections in eight (9.2%) patients, sepsis in three (3.4%) patients and sepsis-related mortality in two (2.3%) patients and was correlated to prolonged hospital stay.

### **Hospital stay:**

The mean hospital stay was (6.45) days, minimal stay was three days, while maximal was twelve days. It was directly correlated to postoperative morbidity.

### **Discussion:**

Literature debate in liberal versus restricted approaches is again arising in this study. Most studies were preferring restricted approach.<sup>(8-11)</sup> In our study 66(75.9%) patients were receiving large amount of fluid. Amounts of fluid varied obviously ranging from (3 – 6 L/day). Three patients received 6 litres/day. Climate status should be considered in a region such as Sudan, as <3 litres appeared to be hazardous for our patients. Types of fluids prescribed were varied in this study, D5% was the commonest fluid used in postoperative period (50%) compared to (43%) in the literature,<sup>(12)</sup> followed by RL, DNS and NS. As well as

different amounts regardless of patient status. Three patient weighing (66 to 80 Kg) have received >5 litres, one of them was aging 68 years. The amount of fluid in relation to weight and age was insignificant; P value 0.3 and 0.6 respectively. Desired volume of fluid was prescribed in (57%) compared to (22%) and (84%) in literature.<sup>(12,13)</sup> Fluid and assessment charts were incomplete and poor. (30%) of patients were followed with just vital signs as seen in patients' follow-up sheets, added fluid charts in (28%) of patients compared to (94%) in literature, systemic examination in only (15%) of patients and lab tests in (25%) patients compared to (85%) in literature.<sup>(14)</sup> While the correlation between simple assessment methods used in this study and the clinical status of the patient was highly significant, P value 0.01, as (70%) of patients who were having complications. Although the body weight measurements being documented in (15%) of patients receiving IV fluids, in the literature<sup>(14)</sup>, in our study, no body weight documented for a single patient. In previous studies, they have found morbidity to be (9%), (25%) and (40%) in patient receiving restricted approach,<sup>(8,11,15)</sup> but in our study we found significant correlation between restricted amount and morbidity; P value 0.01, which has occurred in (61%) of patients, of whom three patients have progressed to renal impairment. As found in the literature, large amounts were related to iatrogenic fluid overload in (7%) of patients, compared to (43%) in our patients.<sup>(16)</sup>

One patient had developed hypokalaemia despite prescribe, this might be explained by missed doses, and could be the reason for high rate of complications in our patients who received restricted fluids.

Under hydration and over hydration were strongly correlated to complications such as hypovolemic oliguria and renal impairment, generalized oedema, respectively with P value 0.01. Hypokalaemia noticed in (14.9%) of patients who have not received potassium replacement in postoperative days, compared to (85%) in another study<sup>(12,13)</sup>. Hypernatraemia was related to over-prescription of sodium-contained IV fluids, ranging from (0 - 675, median 250mmol/day) compared to (0-770, 242mmol/day) in the literature.<sup>(17)</sup> Hypernatraemia was significantly correlated to overload; P value 0.01. Postoperative general complications were paralytic ileus, surgical site infection, sepsis and sepsis-related mortality, representing (13.8%), (9.2%), (3.4%) and (2.3%) of the patients respectively. The association with prolonged hospital stay was significant; P value 0.01.

### **Conclusion:**

It appeared that, no actual superiority in applying liberal or restricted approach. Unwanted outcomes were associated with both approaches, though, restricted approach had more adverse effects than liberal approach, as of the 13 patients who received restricted approach 12 of them developed oliguria and renal impairment, while 8 out of 25 patients who received liberal approach developed generalized oedema. Types and amounts of fluid varied a lot in our study, and consideration of weight and age was very poor. Most common prescribed fluid was D5% in 3 litres dose, followed by RL. The use of sodium-contained solutions was attributed to overload and hypernatraemia. Lack of documentation and poor assessment and follow-up were noted in the study, and training and education programs must be planned, while the study showed significant correlation between regular simple assessment and detection of complications. Hypokalaemia was significantly related to lack of prescription of replacement potassium. A great work should be done by all doctors and nurses as well as quality control personnel's to improve IV fluid management practice, and great care must be given for junior staff. When deprived from enteral intake they become dependent on the parenteral nutrition, to meet body needs.

### **Limitation of the study**

Relatively small sample size, and shorter duration of follow up of discharged patient.

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