Perioperative fluid management

Essay
Submitted for partial fulfillment
Of master degree in Anesthesiology

By

Ahmed Maher Ibrahim
M.B., B.Ch

Under supervision of

Prof. Dr. Mohammed Salah Sarhan
Professor of Anesthesia
Faculty of Medicine
Cairo University

Prof. Dr. Amel Hanafy Abu Al Ela
Professor of anesthesia
Faculty of Medicine
Cairo University

Dr. Dalia saad Abd El kader
Lecturer of Anesthesia
Faculty of Medicine
Cairo University

Acknowledgement

*First of all, I should thank **Allah** the greatest and most merciful not only for helping me through this work, but also for helping me all through my life.*

*I would like to express my profound gratitude and appreciation to **Prof. Dr. Mohammed Salah Sarhan** Professor of Anesthesiology, Faculty of Medicine, Cairo University. Who has been kind enough to spare no effort and no time, to advice and supervise me.*

*And I would like to thank my supervisors **Prof. Dr. Amal Hanafy Abu Al Ela** Professor of Anesthesiology, Faculty of Medicine, Cairo University*

*And **Dr. Dalia Saad Abdel Kader** Lecturer of Anesthesiology, Faculty of Medicine, Cairo University for their constant guidance, support and encouragement.*

Finally, there is no word that can express my deepest and sincere gratitude to my lovely family especially my wife who was and will always be beside me.

Dedication

To my sweet little family

My dear father

My great mother

My lovely wife

My sweet sister

This work would have never come true without your support, generosity & encouragement

Abstract

The administration of **IV fluid** to avoid dehydration, maintain an effective circulating volume, and prevent inadequate tissue perfusion should be considered, along with the maintenance of sleep, pain relief, and muscular relaxation, a core element of the perioperative practice of anesthesia. Knowledge of the effects of different **fluids** has increased in recent years, and the choice of fluid type in a variety of clinical situations can now be rationally guided by an understanding of the physicochemical and biological properties of the various **crystalloid** and **colloid** solutions available.

Key words

I.V Fluids, Crystalloids, Colloids, Hypertonic solutions, Glucose containing solutions

Contents

List of Figures

List of tables

List of Abbreviations

APTT	Activated partial thromboplastin time
ARDS	Adult respiratory distress syndrome
ATP	Adenosine tri phosphate
BHP	Blood hydrostatic pressure
BOP	Blood osmotic pressure
BP	Blood pressure
BW	Body weight
CO	Cardiac output
COP	Colloidal osmotic pressure
CRT	Capillary refill time
CVP	Central venous pressure
DEX	Dextran
ECF	Extracellular fluid
EDM	Esophageal Dopplar monitor
GEL	Gelatin
GIT	Gastro intestinal tract
HB	Hemoglobin
HCT	Hematocrit
HES	Hydroxyl ethyl starch
HR	Heart rate

HS	Hypertonic solution
HSD	Hypertonic saline dextran
ICF	Intracellular fluid
ICP	Intra cranial pressure
IFHP	Interstitial fluid hydrostatic pressure
IFOP	Interstitial fluid osmotic pressure
IL	Interleukin
ISF	Interstitial fluid
IV	Intravenous
LMWH	Low molecular weight heparin
LV	Left ventricle
MW	Molecular weight
NPO	Nil per Os
PAFC	Pulmonary artery floating catheter
PAOP	Pulmonary artery occlusion pressure
PAWP	Pulmonary artery wedge pressure
PCWP	Pulmonary capillary wedge pressure
$P_{ET}CO_2$	End tidal CO_2 tension
PT	Prothrombin time
RES	Reticular endothelial system
RV	Right ventricle
SID	Strong ion difference
SIRS	Systemic inflammatory response syndrome
SVR	Systemic vascular resistance
TBW	Total body water
TBSA	Total body surface area
TEE	Trans esophageal Echocardioghraphy
TEG	Thromboelastography

TNF	Tumour necrotising factor
UOP	Urine output
vWF	Von Willebrand factor

Introduction & Aim of the work

Intravenous fluid therapy is an essential component of perioperative management. Adequate plasma volume is vital in maintaining cardiac output and hence tissue perfusion. Virtually all surgical patients, ranging from those having brief, minimally invasive outpatient procedures to those having major intracavitary surgery, receive at least preoperative and intraoperative fluids; the majority of surgical inpatients receive postoperative fluids for varying intervals. [1]

Perioperative fluid management strategies have undergone several shifts over the past fifty years. Prior to the sixties, fluid restriction during intraoperative period was widely practiced *''keep them dry''*

In 1960s, it was demonstrated that major surgery and trauma were associated with fluid requirements that significantly exceeded that usual rate of fluid maintenance. As a result, fluid administration became less restrictive. [2]

A decade later the choice of fluid became the subject of intense debate and continued till today, as colloid versus crystalloids controversies are still raging on.

In late eighties and early nineties the concept of achieving a "supernormal" oxygen delivery attracted many interests.

Perioperative fluid management requires the correct selection, amount, and composition of fluids based on patient's underlying pathology, state of hydration, type, and duration of surgical stress.

Physiologic changes during surgery and anesthesia lead to shifts in fluid balance. For example, epidural, spinal, or caudal anesthesia may all cause variable amounts of sympathetic blockade. Younger and healthier patients may tolerate sympathectomy, but patients who are severely dehydrated, or on antihypertensive drugs or diuretics, may not be able to respond to the effects of sympathectomy. It is common to administer up to 1 L of fluid before placement of a spinal or to concurrently administer fluid when epidural anesthesia is being induced.

Although inhaled anesthetics do not directly alter fluid losses, all anesthetics may blunt the normal physiologic responses to hypovolemia and the stress response.
The stress response to surgery involves an increase in antidiuretic hormone production, which can be blocked with anesthetics. [3]

Superimposed are the variable effects of intravenous and inhalational agents on the myocardium, venous return, blood pressure, and the vasculature.
Mechanical ventilation can decrease the release of atrial natriuretic hormone and increase the release of antidiuretic hormone resulting in retention of sodium and fluids. [3]

In addition to blood loss, significant third space loss may occur, which essentially involves fluid that is still in the body but not contributing to intravascular volume, oxygen delivery, or waste removal; this is difficult to measure.
Simple restoration of blood volume can be inadequate to ensure survival. Patients undergoing major surgical procedures require fluid replacement beyond simple blood loss, and the anesthesiologist plays a vital role in assessing and ultimately administering appropriate fluid therapy in intraoperative and postoperative clinical settings. [3,4]

Chapter One

Physiology