I.V. fluids

Based on use		
Maintenance fluids	Replacement fluids	Special fluids
5% D 5% D with 0.45% NaCl	NS, DNS, RL, ISOLYTE -G, ISOLYTE-E, ISOLYTE-M, ISOLYTE-P	Inj. Sod.bicarbonate, mannitol, NS 1.6%, 3%, 5% Inj. KCl 25% Dextrose

I.V. fluids

Based on property	
Crystalloids (solution of large molecules)	Colloids (solution of electrolytes) Life saving
RL NS DNS D-5% ISOLYTES	5% Albumin 25% Albumin 10% Pentastarch 10% Dextran -40 6% Dextran -70 10% Hetastarch

5 % dextrose

Composition **:** Glucose 50 gms

Pharmacological basis **:**

Corrects dehydration and supplies energy(170Kcal/L)

Indications **:**

- Prevention and treatment of **dehydration**
- Pre and post op **fluid replacement**
- IV administration of various **drugs**
- **Prevention of ketosis** in starvation, vomiting, diarrhea
- Adequate glucose infusion **protects liver against toxic substances**
- Correction of **hypernatremia**

Contra indications

- Cerebral edema, neuro surgical procedures
- Acute ischaemic stroke
- Hypovolemic shock
- Hyponatremia , water intoxication
- Same iv line blood transfusion – hemolysis , clumping occurs
- Uncontrolled DM , severe hyperglycemia

Rate of adminstration – 0.5 gm/kgBW/hr or 666ml/hr 5 % D or 333ml/hr 10 %D

INVERTED SUGAR SOLUTION

Composition : inverted sugar 100 gms

Pharmacological basis :

half dextrose + half fructose

Indications :

- Prevention and treatment of **dehydration (specially pregnancy)**
- Liver diseases (prevents glycogen depletion)

Adverse effects :

1. Lactic acidosis
2. Hyperurecemia
3. hypophosphatemia

Contra indications

- hereditory fructose intolerance
- Caution in renal & hepatic impairment
- >25gm fructose should be avoided
- more expansive

Isotonic saline(0.9 % NS)

- *Composition* : Na^+ 154 mEq, Cl^- 154 meq

- *Pharmacological basis* : provide major ECF electrolytes..
  corrects both water and electrolyte deficit.
  increase the iv volume substantially

Contra indications

- Avoid in pre eclamptic patients, CHF, renal disease and cirrhosis
- Dehydration with severe hypokalemia – deficit of ICF potassium
- Large volume may lead to hyperchloremic acidosis.

Indications

- Water and salt depletion – diarrhoea, vomiting, excessive diuresis
- Hypovolemic shock
- Alkalosis with dehydration
- Severe salt depletion and hyponatremia
- Initial fluid therapy in DKA
- Hypercalcemia
- Fluid challenge in prerenal ARF
- Irrigation – washing of body fluids

Vehicle for certain drugs

Dextrose Saline (DNS) — D5 C.
(5% Dextrose with 0.9% NaCl Solution)

Composition :

One litre of fluid contains :

Glucose	50 gm	Chloride	154 mEq
Sodium	154 mEq		

DNS

Pharmacological basis :

- Supply major EC electrolytes, energy and fluid to correct dehydration

Indications :

- Conditions with salt depletion ,hypovolemia
- Correction of vomiting or NGT aspiration induced alkalosis and hypochloremia
- Compatible with blood transfusion

Contra indications :

- Anasarca – cardiac, hepatic or renal
- Severe hypovolemic shock (osmotic diuresis)
- >25gm/hr should be avoided

Ringer's lactate (RL)

Composition :

One litre of fluid supplies

Sodium	130 mEq	Calcium	3 mEq
Potassium	4 mEq	Bicarbonate	28 mEq
Chloride	109 mEq		

Each 100 ml contains :

Sodium lactate 320 mg, Sodium chloride 600 mg, Potassium chloride 40 mg and Calcium chloride 27 mg

Ringer's lactate

Pharmacological basis :

- Most physiological fluid , rapidly expand s iv volume..
- Lactate metabolised in liver to bicarbonate providing buffering capacity
- Acetate instead of lactate advantageous in severe shock.

Indications

- Correction in severe hypovolemia
- Replacing fluid in post op patients, burns
- Diarrhoea induced hypokalemic metabolic acidosis
- Fluid of choice in diarrhoea induced dehydration in paediatrics
- DKA , provides water, correct metabolic acidosis and supplies potassium
- Maintaining normal ECF fluid and electrolyte balance

Contra indications

- Liver disease, severe hypoxia and shock
- Severe CHF , lactic acidosis takes place
- Addison's disease
- Vomiting or NGT induced alkalosis
- Simultaneous infusion of RL and blood
- Certain drugs – amphotericin, thiopental, ampicillin, doxycycline

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Isolyte fluids

	Isolyte G	Isolyte M	Isolyte P	Isolyte E
dextrose	50	50	50	50
Na	63	40	25	140
K	17	35	20	10
Cl	150	40	22	103
Acetate	---	20	23	47
Lactate	---	---	---	---
NH4Cl	70	---	---	---
Ca	---	---	---	5
Mg	---	---	---	3
HPO4	---	15	3	---
Citrate	---	---	3	8
Mosm/L	580	410	368	595

Isolyte G :

- Vomiting or NGT induced hypochloremic, hypokalemic metabolic alkalosis
- NH4 gets converted to H+ and urea in liver
- Treatment of metabolic alkalosis
- *Contraindications :* Hepatic failure, renal failure, metabolic acidosis

Isolyte M

- Richest source of potassium (35 mEq)
- Ideal fluid for maintenance
- Correction of hypokalemia
- *Contraindications* : Renal failure, burns, adrenocortical insufficiency

Isolyte P

- Maintenance fluid for children – as they require less electrolytes and more water
- Excessive water loss or inability to concentrate urine
- *Contraindications* : hyponatremia, renal failure

Isolyte E

- Extracellular replacement solution, additional K and acetate (47mEq)
- Only iv fluid to correct Mg deficiency
- Treatment of diarrhoea, metabolic acidosis
- *Contraindications* – metabolic alkalosis

Effects of large volume crystalloid infusion.

- Extravascular accumulation in skin, connective tissue , lungs and kidney
- Inhibition of GI motility
- Delayed healing of anastomosis
- Large volume ,rapid infusion crystalloids causes hypercoagulability..

Ruttmann TG, James MF. Effects on coagulation due to intravenous crystalloid or colloid in patients undergoing vascular surgery.
Br J Anesth 2002 ; 89 : 999 - 1003

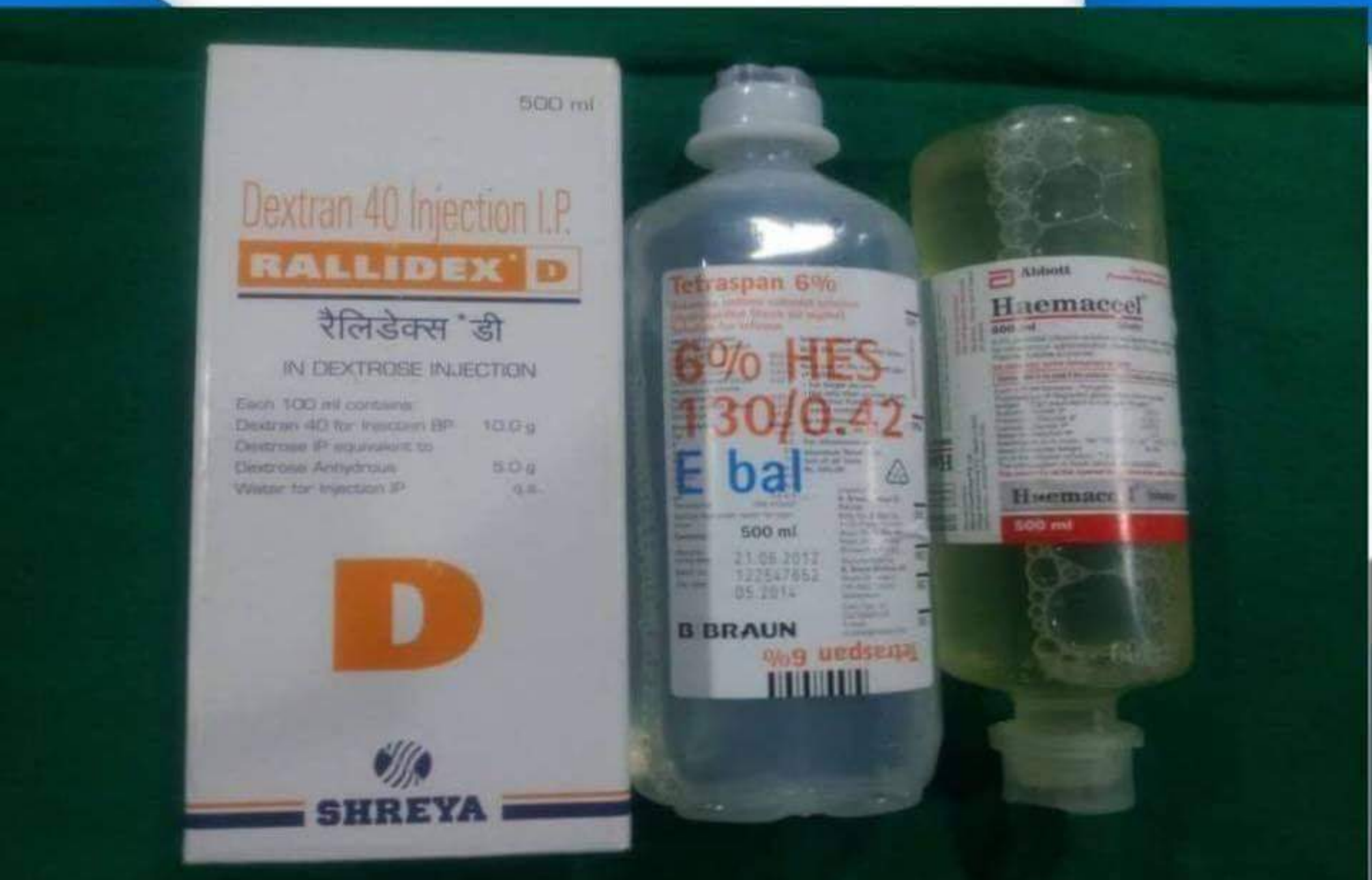
Crystalloids …

Colloids

Colloids : large molecular wt substances that largely remains in the intravascular compartment thereby generating oncotic pressure

- 3 times more potent
- 1 ml blood loss = 1ml colloid = 3ml crystalloids

colloids…


500 ml
Dextran 40 Injection I.P.
RALLIDEX D
रैलिडेक्स डी
IN DEXTROSE INJECTION
Each 100 ml contains:
Dextran 40 for Injection BP 10.0 g
Dextrose IP equivalent to
Dextrose Anhydrous 5.0 g
Water for Injection IP q.s.
D
SHREYA
Tetraspan 6%
6% HES
130/0.42
E bal
500 ml
21.05.2012
122547652
05.2014
B BRAUN
Abbott
Haemaccel
500 ml

Type of fluid	Effective plasma volume expansion/100ml	duration
5% albumin	70 – 130 ml	16 hrs
25% albumin	400 – 500 ml	16 hrs
6% hetastarch	100 – 130 ml	24 hrs
10% pentastarch	150 ml	8 hrs
10% dextran 40	100 – 150 ml	6 hrs
6% dextran 70	80 ml	12 hrs

Albumin

- Maintain plasma oncotic pressure – 75-80 %
- Heat treated preparation of albumin – 5%, 20% and 25% commercially available

Pharmacalogical basis :

- 5% albumin – COP of 20 mmHg
- 25% albumin – COP of 70mmHg ,expands plasma volume to 4-5 times the volume infused within 4-5 min.

Rate of infusion :

- Adults – initial infusion of 25 gm
- 1 to 2 ml/min – 5% albumin
- 1 ml/min - 25% albumin

Indications :

- Plasma volume expansion in **acute hypovolemic shock**, burns, severe hypoalbuminemia
- **Hypo proteinemia** – liver disease, Diuretic resistant in nephrotic syndrome
- Oligourea
- In therapeutic **plasmapheresis , as an exchange fluid**

Contra indications :

- Severe anaemia, cardiac failure
- Hypersensitive reaction

Dextran

- Dextran are glucose polymers produced by **bacteria** (leuconostoc mesenteroides)

  2 forms : dextran 70(MW 70,000) and dextran 40(40,000)

Pharmacological basis :

- **Effectively expand** iv volume, but not suitable for blood transfusion.
- Dextran 40 as 10% sol greater expansion , short duration(6hrs) – rapid renal excretion
- **Anti thrombotic** , inhibits platelet aggregation
- **Improves micro circulatory flow** as preventing thromboimbolism.

Indications :

- Hypovolemia correction
- Prophylaxis of DVT and post operative thromboembolism
- Improves blood flow and micro circulation in threatened vascular gangrene
- Myocardial ischemia, cerebral ischemia as maintaining **vascular graft** patency

Adverse effects

- Acute renal failure
- Interfere with blood grouping and cross matching
- Hypersensitivity reaction

Precautions/CI :

- Severe oligo-anuria
- CHF, circulatory overload
- Bleeding disorders like thrombocytopenia.
- Severe dehydration
- Anticoagulant effect of heparin enhanced
- Hypersensitive to dextran

Administration :

- Adult patient in shock – rapid 500 ml iv infusion
- First 24 hrs – dose should not exceed 20ml/kg
- Next 5 days – 10 ml/kg/ day

Gelatin polymers(haemaccel)

- 500 ml Sterile, pyrogen free 3.5 % solution
- Polymer of degraded gelatin with electrolytes
- 2 types
- Succinylated gelatin (modified fluid gelatin)
- Urea cross linked gelatin (polygeline)

Composition : Na 145 mEq, Cl 145 mEq, Ca 12.5 mEq, potassium 5.1 mEq

Indications :

- Rapid plasma volume expansion in hypovolemia
- Volume pre loading in general anesthesia
- Priming of heart lung machines

Advantages :

- Does not interfere with coagulation, blood grouping
- Remains in blood for 4 to 5 hrs
- Infusion of 1000ml expands plasma volume by 50%

Side effects :

- Hypersensitivity reaction
- Bronchospasm, hypotension
- Should not be mixed with citrated blood

Hydroxyethyl starch

Hetastarch :

- It is composed of more than 90% esterified amylopectine.
- Esterification retards degradation leading to longer plasma expansion
- 6% starch - MW 4,50,000

Pharmacological basis :

- Osmolality – 310 mosm/L
- Higher colloidal osmotic pressure
- LMW substances excreted in urine in 24 hrs

Advantages :

- Non antigenic
- Does not interfere with blood grouping
- Greater plasma volume expansion
- Preserve intestinal micro vascular perfusion in endotoxaemia
- Duration – 24 hrs

Disadvantages :

- Increase in *S amylase* concentration upto 5 days after discontinuation
- Affects coagulation by prolonging PTT, PT and bleeding time by lowering fibrinogen
- Decrease platelet aggregation , VWF , factor VIII

Contra indications :

- Bleeding disorders , CHF
- Impaired renal function

Administration :

- Adult dose 6% solution – 500ml to 1 lit
- Total daily dose should not exceed 20ml/kg

Special fluids

- Inj KCl 10 ml amp – 20mEq
- 25%D (25 ml amp or 100 ml infusion bottle)– in hypoglycemic shock
- Inj. Sodium bicarbonate (25 ml amp. 22.5mEq Na^+ & 22.5mEq $HCO3^-$) dose = 10-15 mEq/L : in metabolic acidosis
- Mannitol 10% & 20% : osmotic diuretic