It is the surgery that deals with children & newborn babies, the children are subjected to all problems of the adults in addition to special conditions.

No body wants to operate a newborn baby unless he / she is born with some congenital anomalies, so that if we leave him / her either will die or become crippled . So, neonatal surgery is done only when there is a very necessary indication for it.

**General principles:**

Infants and children, in general , show major differences from adults . Their body systems have yet to develop and their full physiological functions and reserves are small .Thus it is easy for a small change to produce organ failure in one system ; which may lead to failure of other systems.

**Rate of change.** children are very fragile ; a child can be moribund from meningitis within 24 hours or become dehydrated from gastroenteritis to the extent of peripheral circulatory failure in a day .

**Temperature regulation** .The small baby is easily affected by changes in environment temperature. This is due to:

- Thinner layer of subcutaneous fat.
- Inadequate vasoconstriction of cutaneous vessels in response to cold .
- Absent or rudimentary shivering and sweating mechanisms.
- Incomplete myelination of the CNS including the central heat regulating center in the hypothalamus .As result , all premature babies and most neonates will require incubators or at least wrapping of limbs and body with cotton wool to minimize heat loss.
Body fluids electrolytes  80% of the full-term baby's weight is water. This drops to 60% in adults. Maintenance of fluid and electrolyte balance is vital in the neonatal period. If oral intake is not feasible IV daily fluids are given.

- Daily fluid maintenance is given in the formula of 10% glucose in 0.18 percent saline. Potassium chloride (20mmol/L) is added once urine flow is established.
- The fluid requirement of the neonate may be calculated according to

  Neonate 60 ml/kg to be raised by 10 ml/kg daily up to 100 ml
  
  \[
  \begin{align*}
  & < 10 \text{ kg} \quad 100 \text{ ml/kg} \\
  & > 10 \text{ kg} \quad 50 \text{ ml/kg}
  \end{align*}
  \]

  for the first 10 kg + 50 ml for each additional kg of body weight

- All fluid losses, for example, nasogastric aspirate and ileostomy losses are replaced with normal saline with potassium chloride (20mmol/L).
- The above are merely guidelines and each case must be assessed individually with repeated electrolyte estimations.

Blood volume. In a neonate, the blood volume is about 80 ml/kg body weight (70 ml/kg in adults). Thus a 3.5 kg neonate will have 280 ml total blood volume. Three blood stained swabs during surgical operation will contain 30 ml of blood which constitute 10% of the total blood volume. Such loss is significant in neonates but very negligible in adults. Blood transfusion may be resorted to in restricted indications, e.g. Blood loss, haemolytic anaemia or severe anaemia. A general formula of 10 ml/kg of blood or 5 ml/kg of packed RBCS usually adequate.

Respiratory system. The lungs have sufficient capacity for postnatal survival at about 24 weeks gestation. After delivery, the lung matures rapidly but only about half of the alveoli are present at birth. It is worth remembering that the most energy consuming activity of the neonate is breathing. This explains the rapidity with which respiratory failure develops in babies with pneumonia.

Hepatic function. The newborn liver is still immature. The most common example of this is the physiological jaundice that is brought about by the underdeveloped glucoronyl transferase system. Many other enzymes and functions are also involved, e.g. albumin, clotting factors and vitamin K. The liver acts also as a carbohydrate store in the form of glycogen. Even the full-term baby can not withstand starvation more than 6 hours without running the risk of hypoglycaemia.
Central nervous system: Myelination within the central nervous system is poorly developed at birth. The swings in heart and respiratory rate and temperature regulation are examples of the immature negative feedback loops at birth. The process of myelination is not completed until the late teens. The development milestones of childhood are related to the gradual maturation of the cortical connections within the brain.

Pain relief and analgesia. It was commonly stated that infants do not feel pain because of lack of central myelination. There is enough evidence to suggest that babies and small children produce physiological response to pain. It is also important to remember that the blood brain barrier is less efficient until 2 years of age due to incomplete myelination. As a result, fat-soluble drugs will permeate more freely into the cell in the brain in the age group. Thus opiates may produce respiratory depression at low doses. For example, morphine is given to adults in a dose of 0.2 mg/kg 6-8 hourly, but in the small infant 0.1 mg/kg 6-8 hourly is enough.

Neonatal Intestinal Obstruction

1) Mechanical
   It means there's organic lesion which could be:

   [A] Intrinsic (in the wall); this includes either atresia (which means failure of continuity) or stenosis (which means narrowing or web).

   [B] Intraluminal as in meconium ileus.

   [C] Extrinsic as in malrotation, annular pancreas (C-shaped pancreatic tissue around the 2nd part of duodenum), diagrammatic hernia, volvulus & duplication.
[D] Neurological as in Hirschsprungs disease (absence of parasympathetic ganglion cell), so no compulsive activity that causes failure to pass meconium causing NIO.

2) Functional:

[A] Sepsis & septicemia
[B] Necrotizing enterocolitis.
[C] Prematurity.
[D] Drugs used during labor such as overdose of anesthesia.

Meconum Ileus:

This is abnormal meconium which is inspissated (muco – viscid) & impacted in the distal ileum, 10-15% of cystic fibrosis have meconium ileus. Meconium that produce obstruction in meconium ileus differ from other meconium (it has less water content 65%- in normal meconium 75%-lower sucrose & lactase levels, increase albumin & decrease pancreatic enzyme.) within the duodenum & proximal jejunum during the later months of fetal life & the mixture become progressively inspissated & inherent to the distal 15-30 cm of ileum with small colon due to un-use atrophy (i.e. Micro colon).

Polyhydramnios occur in 10-20% of the time the newborn is often small for gestational age, but prematurely is unusual.

Meconium ileus is classified into: uncomplicated & complicated cases.

Uncomplicated ME:

In this condition the abnormal thickened meconium causes simple intestinal obstruction at the terminal ileum. The distal 15-30 cm of terminal ileum is filled with inspissated meconium pellets which are adherent to the bowel wall. The neonate may appear normal for the 1st 12-18 hours of life, as proximal bowel fills with swallowed air, the abdominal distension, vomiting (initially
clear, later bilious) & failure to pass meconium are noted. On abdominal examination a doughy abdominal mass maybe present.

**Investigations:**
1) plain abdominal X ray: no air – fluid level or fewer air fluid levels (it’s the only intestinal obstruction without air – fluid level), but there’s ground glass appearance or soapbubble in the right lower quadrant, less rectal gas than neonatal Hirschsprungs disease or Meconium plug syndrome.
2) Diagnostic enema; by using gastrografin (diatrizoate meglumine) which contains wetting agent & draws large volume of fluids into the lumen to wash out the obstructing meconium, so its diagnostic & therapeutic.
3) Sweat test; as in any patient with cystic fibrosis.

**Treatment:**
Conservative:
1) NG tube for decompression of stomach & bowel.
2) IVF to replace preexisting fluid deficits & ongoing losses.
3) Abs.
4) Incubator with O₂
5) Therapeutic enema.
Operative:
One or more enterostomies can enable the surgeon to relieve simple meconium ileus. If the general condition of the patient is un - well, then an ileostomy is done.
Complicated ME

This condition is associated with volvulus, bowel perforation, intestinal atresia & giant cystic meconium peritonitis.

Clinical Features:

1) The same of uncomplicated but abdominal distension occurs shortly after birth.
2) There is usually scrotal or vaginal swelling due to fluid accumulation in the patent process vaginalis or fimbriated ends at the fallopian tube.

Diagnosis:

1) Intrauterine life diagnosis by fetal US.
2) Plain abdominal X ray: air – fluid levels & distended loops of small bowel & intraperitoneal calcification due to intrauterine perforation.

Treatment:

1) IVF.
2) NG.
3) Incubator with O2.
4) Abs.
5) If the condition of the patient is stable then resection & primary end to end anastomosis.
6) If sepsis present, do diverting ileostomy & after improvement closure is performed.

Meconium plug syndrome:

Is a rare, benign form of colonic obstruction in the neonate that bears no relationship to meconium ileus. The colon dysmotility allows the meconium in the left colon and rectum to become firm so that a plug is form that cannot be passed.
Characteristically:

The newborn passes only some small inspissated meconium or none at all. The abdomen becomes distended, vomiting is late occurrence. Abdominal x ray shows dilated bowel loops with air – fluid levels, more colonic & rectal gas than a patient with Hirschsprungs disease.

Treatment:

- The meconium plug may be dislodged and pass after stimulation of the anus & rectum with physical examination.
- using a contrast enema, the enema is performed using the same technique as in the diagnosis of meconium ileus.
Colu. (small)

Proximal ileum

Mid ileum contains thick and tenacious meconium

Distal ileum contains concretions