The Collapsed Neonate

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How things have changed

• 20 years ago duration of hospital stay after birth much longer
• SHO experience on post natal wards
• 6 hour discharge
• Increase in home births
• Even post LSCS discharge at 2 to 3 days
• All these mean more neonates presenting to Emergency Facilities
Plan for Session

• Take 1 collapsed newborn
• Follow through initial presentation to ED
• Look at the differential diagnosis and management in the first hour
Baby A

- Arrives with mum at 10pm
- Brought from triage to resus room
- Crash call put out as baby is pale and floppy
- Team members: ED middle grade +/- consultant, general paediatric SHO and registrar, Anaesthetic registrar, PICU registrar, 2 ED nurses
Initial history

• 6 days old
• Born at Term by SVD weight 3.2kg
• Uneventful pregnancy
• Discharged following day
• Formula feeding, bit sicky after feeds
• Gradually more lethargic over past 2 to 3 days.
• Feeding less well
• Vomiting more frequently
Initial Assessment

- Pale
- Resps 60 with some recession
- HR 150s
- Normal CRT
- Very floppy
- Withdraws and cries with painful stimulus
- Oxygen administered
- BM 2.7
Interventions

• Airway adjunct if required
• Continue high flow oxygen
• IV access, urgent blood gas
• Administer 10% glucose 2mls/kg
• Reassess
During the sugar bolus

• Patient starts to have a convulsion
• VBG: H+96, pCO2 6.4, pO2 4.8, Bic 12, BE -15, Lactate 3.2
### Aetiology of Neonatal Seizures

<table>
<thead>
<tr>
<th>Aetiology</th>
<th>Early</th>
<th>Late</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypoxic/ischaemic</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Subarachnoid</td>
<td>+</td>
<td></td>
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<tr>
<td>IVH</td>
<td>+</td>
<td>+</td>
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<tr>
<td>Subdural</td>
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<td>+</td>
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<tr>
<td>Cerebral Infarction</td>
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<td>+</td>
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<tr>
<td>In utero infection</td>
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<td>+</td>
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<tr>
<td>Post natal infection</td>
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<td>+</td>
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Neonatal seizure (cont.)

<table>
<thead>
<tr>
<th>Aetiology</th>
<th>Early</th>
<th>Late</th>
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</thead>
<tbody>
<tr>
<td>Hypoglycaemia</td>
<td>+</td>
<td>+</td>
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<tr>
<td>Hypocalcaemia</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Aminoaciduria</td>
<td></td>
<td>+</td>
</tr>
<tr>
<td>Pyridoxine deficiency</td>
<td>+</td>
<td>Rare</td>
</tr>
<tr>
<td>Drug withdrawal</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Familial benign seizures</td>
<td>+</td>
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How to treat the seizure

• Being aware that there is something underlying doesn’t change how you manage the seizure which remains as per APLS guidelines
• 1st line, IV lorazepam successfully stops the seizure after 3 minutes
• Now to think what might have caused the collapse, mindful that seizure has become one of the main features.
Consider causes of collapsed neonate

• THE MISFITS
## Differential diagnosis

<table>
<thead>
<tr>
<th>T</th>
<th>Trauma/NAI</th>
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<tbody>
<tr>
<td>H</td>
<td>Heart disease</td>
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<tr>
<td>E</td>
<td>Electrolyte disturbance</td>
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<tr>
<td>M</td>
<td>Metabolic disturbances</td>
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<tr>
<td>I</td>
<td>Inborn error metabolism</td>
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<tr>
<td>S</td>
<td>Sepsis</td>
</tr>
<tr>
<td>F</td>
<td>Formula mishaps</td>
</tr>
<tr>
<td>I</td>
<td>Intestinal catastrophes</td>
</tr>
<tr>
<td>T</td>
<td>Toxins</td>
</tr>
<tr>
<td>S</td>
<td>Seizures/ CNS abnormal</td>
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</tbody>
</table>
T - Neonatal Trauma

• Birth related/ inflicted injury
• Consider head trauma +/- abdominal organ/long bone injury
• All of the above can cause enough blood loss to be shocked
• Absence of CV instability makes less likely
• Isolated head trauma/shaken baby may fit and would certainly fit with seizures in this age group.
• Hypoglycaemia may be because of not being fed or just coincidental
H - Congenital Heart Disease

• Accounts for 10% infant mortality
• Incidence 8-10 per 1000 live births
• Commonest to present in neonatal period are duct dependent systemic outflow tract obstruction, classic being Coarctation of the Aorta
• Unlikely at this point to be able to identify the precise cause and often murmurs are absent, however may have gallop rhythm, hepatomegaly and absent peripheral pulses
• In either case would expect baby to have more signs of CV instability with a significantly worse blood gas
• In these babies it may be the failure to respond to usual therapies that would lead you to suspect CHD and to try using Prostin.
E - Endocrine

• Classic presentation in this group would be Congenital Adrenal Hyperplasia (name given to several AR diseases causing either excessive or deficient production of sex steroids)

• In the collapsed neonate this is due to the type resulting in inadequate mineralocorticoids). Infants present with vomiting, hypoglycaemia, hyperkalaemia and hypotension unresponsive to fluids and inotropes

• Treated with a bolus of hydrocortisone

• Should be electrolyte abnormalities on the blood gas along with CV instability
I - Inborn errors of metabolism
In practice....

• I will not make the diagnosis here...
• It will usually be after dealing with the most common causes of collapse and not sorting the problem out that this will be considered
• These children present with a lactic acidosis, hypoglycaemia, hyperammonaemia or all of the above
• Seizures is often the presenting feature
• My job is to consider this and to send an ammonia with the initial biochemistry, meanwhile treating the hypoglycaemia and consider the use of steroids after discussing with a metabolic specialist
Sepsis

• This is by far the most common cause of collapse in this age group and therefore
• Must be considered in all collapsed neonates
• Sources of infection
  • CNS (meningitis/ encephalitis)
  • Urinary tract
  • Group B strep septicaemia
• Empirical broad spectrum antibiotics indicated
• 2 peaks of incidence of GBS, 1 early and 1 at 4-6 weeks of age.
Things to consider

• Neonates struggle to mount a febrile response and may be cold rather than febrile

• In ALL collapsed neonates, never a bad idea to give IV antibiotics
Neonate with Sepsis
Other Clinical Features of Sepsis

<table>
<thead>
<tr>
<th>Temp instability</th>
<th>Hypotension</th>
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<tbody>
<tr>
<td>Resp distress</td>
<td>Tachycardia</td>
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<tr>
<td>Feed intolerance</td>
<td>Apnoea/bradys</td>
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<tr>
<td>Vomiting</td>
<td>Irritability</td>
</tr>
<tr>
<td>Abdo distension</td>
<td>High pitched cry</td>
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<tr>
<td>Diarrhoea</td>
<td>Lethargy</td>
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<tr>
<td>Jaundice</td>
<td>Weak suck</td>
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<tr>
<td>Pallor</td>
<td>Convulsions</td>
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<tr>
<td>Skin rash</td>
<td>Full fontanelle</td>
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F - Formula mishaps
Formula mishaps

- These are not so common in the western world but parents do sometimes not understand how to make up a formula feed
- Over dilution resulting in hyponatraemia
- Under dilution resulting in hypernatraemia
I - Intestinal catastrophes

• Those presenting in the neonatal period tend to be either
• Malrotation with volvulus or
• Necrotising enterocolitis
Malrotation
I Intestinal catastrophes

• These tend to present with bilious vomiting which is unusual in any age of child and is therefore always significant

• Resuscitation of these children will include all the initial treatments but would then require NGT and the addition of metronidazole to the antibiotic cover.

• These children tend to have obvious abdominal distension as seen in the preceding slides
T - Toxins
T  Toxins

- Unusual cause
- Can result from maternal drug ingestion in breast feeding mum
- Overuse of homeopathic/ standard medications
- May be a late presentation of drug withdrawal
- We now have urine tox screen kits in the ED
Seizures/ CNS

• Difficult to diagnose the underlying cause in ED
• Immature cortical development so may not see typical tonic clonic or generalized seizures
• May see
  • lip smacking
  • abnormal eye / tongue movements
  • apnoea
• Treat according to APLS guidelines
So....back to our baby

• Presented collapsed but oxygenated well, well perfused, no heart murmur, hypoglycaemic, seizing with a low grade temp

• What’s the most likely cause?

• What do you do next?

• What other tests need done to confirm?

• Who needs to be involved?
Summary

• Neonates can be tricky....
• Lots of potential issues
• Treat the common
• Do sensible investigations that will help you.
• Awareness of some of the more unusual causes will help you to do appropriate investigations early to assist with diagnosis once you have treated the common.