



British Association of  
Perinatal Medicine



# **Management of Bilious Vomiting in the Newborn Period and Radiological Support for Neonatal Services**

**A Framework for Practice**

**February 2024**

## Contents

Executive Summary.....	3
Members of Working Group.....	4
Introduction and Background.....	5
Summary of evidence.....	7
Pathway for Bilious Vomiting and Exclusion / Diagnosis of Malrotation Volvulus.....	9
Minimum Requirements for Radiological Support for Neonatal Units.....	13
References.....	15
Appendices: Parent leaflet.....	16

## Executive Summary

Bilious vomiting is a common symptom in the newborn and can indicate pathology. In particular, there are concerns that there could be malrotation / volvulus which can present with no other symptoms. A surgical diagnosis occurs in about 25% of term babies with bilious vomiting but only about 8% have malrotation. Many babies are transferred for urgent contrast studies to exclude the possibility of malrotation.

In term babies with bilious vomiting assess carefully, consider other diagnoses and treat for infection. Consider the possibility of surgical problems and discuss cases with a surgeon and a neonatologist. A care pathway for these babies is suggested which can be used to inform local guidelines. A separate pathway is suggested for preterm babies.

Some minimum standards for radiology cover for NICUs / LNUs and SCUs are suggested.

## Members of Working Group

<b>Chair</b>	Stephen Wardle	Consultant Neonatologist, Nottingham University Hospitals. Hon. Sec. BAPM
<b>NICU Rep</b>	Ajay Sinha	Consultant Neonatologist, Royal London Hospital.
<b>Trainee Rep</b>	Claire Granger	Newcastle upon Tyne Hospitals, NHS Foundation Trust.
<b>Transport Rep</b>	Catherine Harrison	Consultant Neonatologist, Leeds Teaching Hospitals. Chair Neonatal Transport Group.
<b>Radiology Representative</b>	David Horton	Hull University Teaching Hospitals NHS Trust. President British Society of Paediatric Radiology.
<b>Surgical Rep</b>	Nigel Hall	Consultant Paediatric Surgeon, Southampton.
<b>Surgical Rep</b>	Rania Kronfli	Consultant Paediatric Surgeon, Glasgow.
<b>Nursing Rep</b>	Rhiannon Jones	Advanced Nurse Practitioner Great Ormond Street NHS Trust.
<b>LNU / SCU Rep</b>	Manjunath Shetty	Consultant Neonatologist, University Hospitals Dorset NHS Foundation Trust.
<b>Networks Rep</b>	Elizabeth Langham	Network Director, East of England Operational Delivery Network.
<b>Parent Rep</b>		

## Introduction and Background

The national neonatal GIRFT report (2021) [1] identified problems with radiological support to neonatal units. This ranged from some units not having on site capacity to do plain radiographs 24 / 7 but was most notable in the management of babies who need upper gastrointestinal (GI) contrast studies for bilious vomiting. The findings from the report prompted the development of this framework as there were no published standards for radiological support for neonatal units and the development of a pathway for babies with bilious vomiting in the newborn period was recommended to help identify and recommend best practice.

Unfortunately, there are some limitations on the availability of upper GI contrast studies, and this has resulted in transfer of many babies to units / hospitals which do have the facility, sometimes over long distances, placing pressure on transport services and capacity in some networks. Various pathways have been developed across different networks to deal with these babies as highlighted in the GIRFT report.

As a framework for practice, this document sets out information and uses this to offer some guidance to help clinicians create local guidelines but it does not override appropriate clinical judgement by those caring for the patient.

This framework will aim to set some minimum (and optimal) standards for radiological support for neonatal units and define a framework for the management of babies with bile-stained vomiting.

### Current situation

In 2021 the neonatal GIRFT review was carried out using data from 2018/2019 available from the neonatal services themselves along with other national data sources. The data were also supplemented with unit visits to each service.

From these data: between April 2018 and March 2019, 721 term infants (37+ weeks gestation) admitted to neonatal units in the first week of life had 974 upper GI contrast studies within 14 days. A quarter of neonatal units (56% NICUs, 20% LNUs and 5% SCUs) did at least one GI contrast study and two hospitals did a quarter of all the studies, with more than 50% of studies done by just six hospitals.

Access to upper GI contrast studies was very patchy with only a third of NICUs having 24/7 access although it was available in some LNUs and SCUs. Surprisingly, even some surgical NICUs did not have a 24-hour service. There was a mix of provision, with some services wholly provided by paediatric radiology, and others where the service was shared with adult radiology colleagues. The 'deep dive' GIRFT visits revealed that the problems with access to radiology and radiography services were not confined to upper GI contrast studies and there were problems accessing portable plain X-rays in some units, with standalone maternity hospitals particularly vulnerable to gaps in service/ no on-site services after hours.

These data, together with information from deep dive visits, suggests that large numbers of babies are requiring urgent transfer to another hospital, often out of hours, for an upper GI contrast study and surgical review, followed by a subsequent journey back to their local hospital in many cases. At a conservative estimate, this is likely to affect in excess of 500-600 babies a year which is consistent with numbers from a previous UK-wide audit of transfers for bilious vomiting [1]. This places a significant burden on neonatal transport services, reducing availability of the service for other sick neonates, and often results in unnecessary mother and baby separation. In some regions, transport

services do not have the capacity to support transfer of these babies and local hospitals are required to undertake the transfer themselves, resulting in variable quality of transport service provision, significant delays in time taken to perform contrast study, as well as pressure on both the local ambulance service and local hospital teams. This also results in a potentially unnecessary admission to surgical NICUs.

There is currently a very inequitable service, with some neonatal units of all designations being able to access contrast studies at least some of the time. Some transport services have a pathway to provide “drive-by” contrast studies, whereby the baby is transported direct to the radiology department in the receiving hospital for the contrast study, where they are also seen and reviewed by the surgical team and, if there is no pathology, the transport team repatriate the baby straight back to the referring unit without admission to the surgical NICU. We have used information from some of these pathways in the development of this framework.

Several other important findings with regard to radiology were revealed from the GIRFT visits:

- Lack of 24/7 upper GI services – only present in a third of NICUs and not present in all neonatal surgical units.
- High volumes of transfers some unable to be done by transport services. There are significant problems with delays in transfers due to ambulance service provision in these cases, inexperienced staff undertaking the transfer and families or staff being stranded at the NICU following a normal contrast, with long delays to get repatriated.
- Access to emergency radiography services, particularly at night, can be very slow.
- Access for radiography service at night not available on site (for some NICUs – standalone units predominantly).
- Neonatologists reporting all of the X-rays with no official radiology report.
- Adult radiology anxiety around doing and reporting scans generally (not specific to upper GI) and therefore giving many caveats in reports.
- Shortage of paediatric radiology support in many units (national shortage).

## Summary of evidence

Bilious vomiting in the newborn in the first few postnatal days has always been regarded as an important clinical sign which could indicate underlying pathology although it can also be seen in babies without pathology. It can be a sign of GI obstruction and importantly can be an indicator of malrotation / volvulus.

Malrotation is a congenital abnormality which results in an abnormal orientation of the bowel and mesentery. It can lead to volvulus (twisting) of the bowel which can result in bowel ischaemia and can be life threatening. Malrotation cannot be diagnosed on a plain abdominal x-ray as it does not show the orientation of the bowel and a contrast study is therefore required. As a result, common practice is that infants with bile-stained vomiting have an upper GI contrast study to exclude malrotation performed. This is usually treated as an urgent investigation.

In recent years, probably following incidents in some centres [2], the fear of missing a diagnosis of malrotation and volvulus has resulted in the idea that **all** babies with bile-stained vomiting should have an urgent contrast study to exclude this diagnosis. Because contrast studies are not available at every centre or even every NICU, this has resulted in a large number of transfers of babies for this and a heavy demand on the centres which do provide this service as seen in the GIRFT report.

Several studies have looked at the diagnosis of term babies undergoing contrast studies and the frequency of malrotation / volvulus in this group. These studies are summarised in Table 1.

**Table 1: Summary of studies**

Author	Year	Number of babies	Surgical diagnosis	%	Evidence of infection	%	Malrotation	%
Malhotra [3]	2009	61	16	26.2%			6	9.8%
Ojha [4]	2016	165	34	20.6%	13	8.6	10	6.1%
Lee [5]	2020	48	7	14.6%	14	29.2	4	8.3%
Mohinuddin [6]	2014	163	75	46.0%	6	3.7	20	12.3%
Cullis [7]	2018	351	41	11.7%	28	8	16	4.6%
Nundeekasen [8]	2021	393	113	28.8%			31	7.9%
Birajdar [9]	2017	164	60	36.6%			51	31.2%
Godbole [10]	2002	63	24	38%			4	6.3%
Drewett [11]	2016	161	14	8.7%			14	8.7%
Lilien [12]	1986	45	14	31.1%	0	0	5	11.1%
<b>Total / Average</b>		1614	398	24.7%	61	8.4%	161	10.0%

The studies included in this table had different inclusion criteria and some were very selective as they reported outcomes from tertiary referral surgical centres which may influence the reported incidence. Some did not report the incidence of infection. As can be seen from the table, only a minority (approximately 10%) have a diagnosis of malrotation / volvulus. Approximately 8% have evidence of infection and 25% have other surgical problems such as lower GI obstruction. If a baby has clear evidence of an alternative explanation for the bile-stained vomiting, then there is not the same need or urgency to exclude malrotation as a diagnosis.

The importance of performing a contrast study is to rule out malrotation and it is only required in the group where this is necessary in the absence of another clear diagnosis.

**What Facilities / Personnel are Required for a Centre to Carry Out Contrast Studies? (See page 14).**



## Pathway for Bilious Vomiting and Exclusion / Diagnosis of Malrotation Volvulus

### What is bilious vomiting?

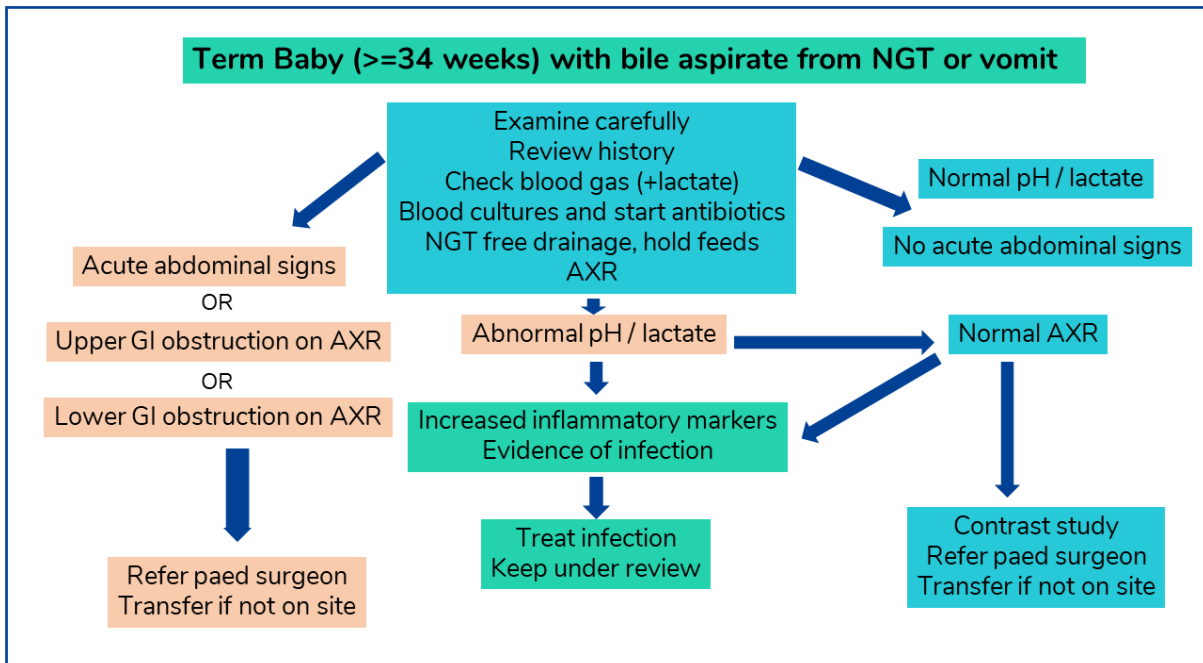
Bilious vomiting is when there is a significant (more than just a spot or two on the sheets) quantity of green (usually dark green) **not** yellow vomit [13]. Whilst yellow vomit may not indicate obstruction persistent yellow vomiting may also need investigating. The following is also helpful [14].

Chart 1

True bile-stained vomit that requires immediate attention is DARK GREEN like these.		Milk
		Lemon
		Lime
		Avocado
		Pea
		Spinach

### Term (and Near Term) Babies (>=34<sup>+0</sup> weeks gestation)

Figure 1: Term Baby (>=34 weeks) with bile aspirate from NGT or vomit



## Management

- Examine carefully
- Is there a normal anus?
- Was there a delay in passage of meconium?
- Normal antenatal scans?
- Review pregnancy and birth history: meconium-stained liquor (which may have been swallowed), risk factors for infection (e.g. PROM, maternal infection, chorioamnionitis).
- Insert a large bore nasogastric tube (if not already in place)
- Perform a plain abdominal x-ray (after NGT insertion)
- Check bloods (including blood cultures, blood gas and CRP (repeat after 24 hours))
- Commence antibiotics
- Consider commencing IV fluids if there will be a significant delay

Following these initial actions there should be an assessment by a senior neonatologist / paediatrician (middle grade or equivalent or consultant) and if a surgical diagnosis is considered likely or if it is considered necessary to exclude a diagnosis of malrotation, the surgical team should be consulted.

If surgical services are at a different site, a conference call discussion should be held with the referring neonatologist, receiving tertiary neonatologist, transport team and paediatric surgeon. It is recognised that services differ geographically and babies may present to different locations depending on local pathways. Some of these infants may be admitted to PICUs but similar processes should be followed. Some may present to Emergency Departments if they have already been discharged and there is some anecdotal evidence these may be a high risk group.

### 1. Babies who require urgent surgical review or urgent transfer for surgical review

These are babies where there are abnormal abdominal signs (tenderness, distension) and / or evidence of lactic acidosis. A malrotation / volvulus is possible in babies with these signs, and they should be transferred as a time critical transfer. A contrast study may be required but these babies need urgent surgical review and some of the babies in this group may need urgent surgery.

If there is evidence of upper GI obstruction, lower GI obstruction, perforation or NEC on the clinical and plain abdominal x-ray assessment it is likely that a contrast study will not be required but the baby will require surgical care: – a conference call discussion with a tertiary neonatologist and paediatric surgeon is ideally required for transfer to the tertiary surgical NICU.

### 2. Babies where another diagnosis is likely

In babies with a normal examination and AXR but with evidence of infection (increased CRP, positive blood culture):

- Continue antibiotics and re-evaluate after initial treatment.
- If bilious vomiting persists after treatment for infection discuss via conference call with tertiary neonatologist and paediatric surgeon and consider a contrast study.

### 3. Babies who require upper GI contrast

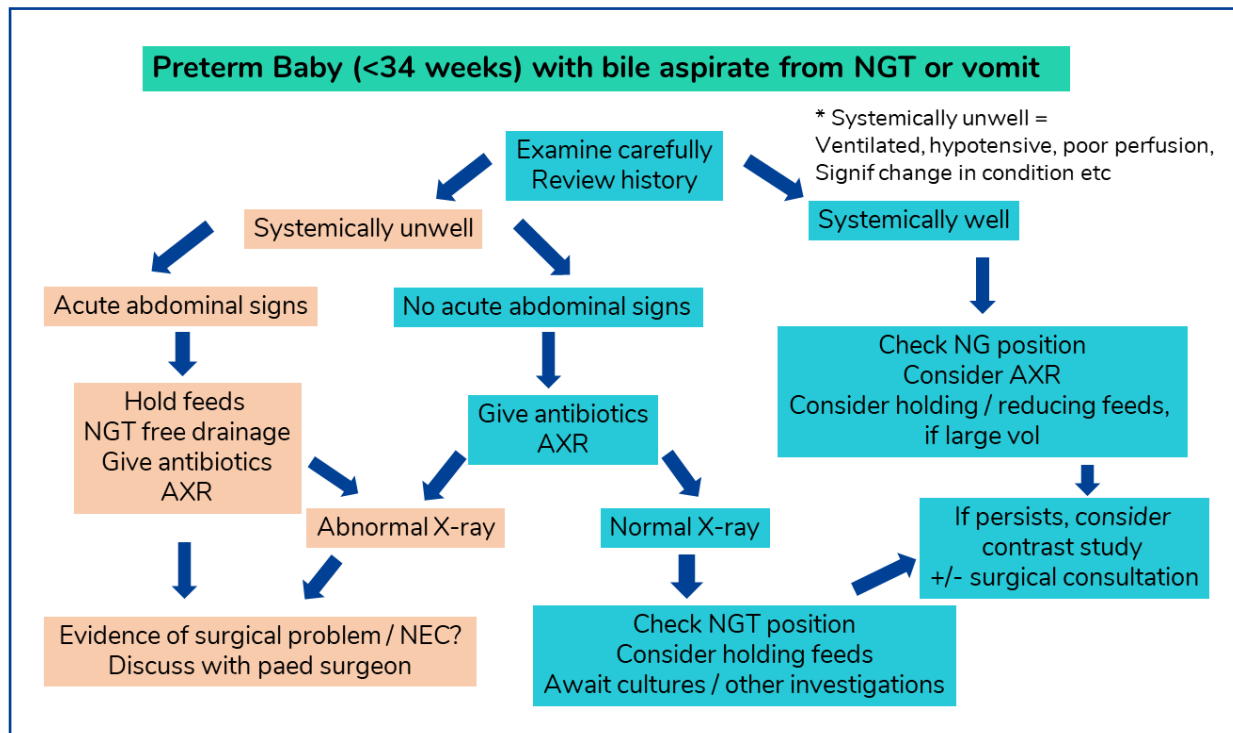
Babies with no other diagnostic features (normal x-ray, normal or minimally abnormal examination, no evidence of infection) are the ones who require a diagnostic contrast study to exclude a diagnosis of malrotation (see flow diagrams). In these circumstances a contrast is required but in the absence of evidence of acute abdominal pathology it does not need to be time critical if the baby is stable and well with no other signs. In some regions it may be possible to carry out a contrast study locally, if appropriate, and in some cases, this may avoid the need for transport.

Any babies where there are abnormal abdominal signs or an abnormal abdominal x-ray should be discussed with a paediatric surgeon as described above.

If there is any evidence of a lactic acidosis or if there is abdominal tenderness then the transfer should be time critical and the contrast study performed urgently and it is likely that transfer to a surgical unit and admission will be required.

### Preterm Babies (<34<sup>+0</sup> weeks gestation)

Figure 2: Preterm Baby (<34 weeks) with bile aspirate from NGT or vomit



Preterm babies <34 weeks do not often vomit but will often have an NGT in place and may be found to have green NG aspirates. The incidence of malrotation / volvulus in preterm babies is likely to be similar to the incidence in term babies. This is estimated at 1 in approximately 8500 babies (6% of term babies referred for contrast studies) but it is obviously seen more frequently in term babies because of the relative numbers and in preterm babies NEC and gut dysmotility have to also be considered as a differential diagnoses.

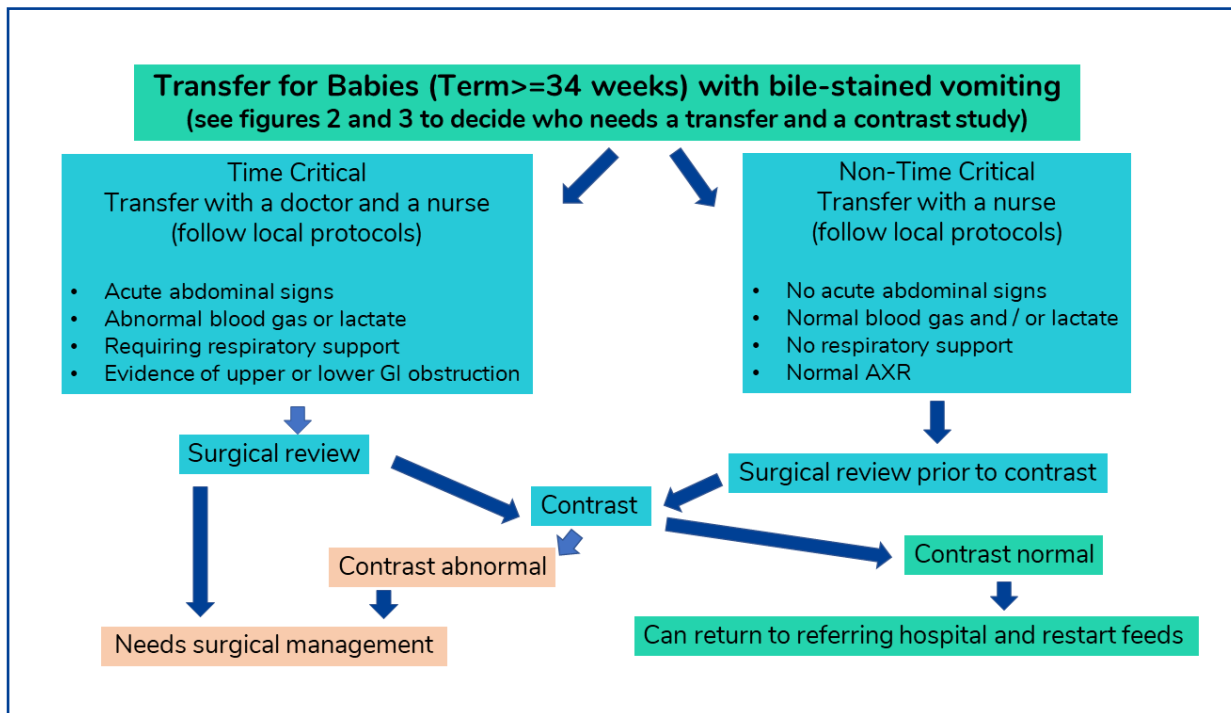
#### Management

- Examine carefully: Is there a normal anus?
- Was there a delay in passage of meconium?
- Normal antenatal scans?
- Check position of NG tube (if beyond pylorus withdraw to correct position).
- Consider possibility of abdominal problems e.g. NEC – is the abdomen distended, discoloured, tender? Has the baby opened bowels? Is the stool normal?
- Are there any other signs of infection? Temperature, respiratory distress, irritability etc.
- Is the volume of green vomit / aspirate large? If not replace and continue feeds but observe closely.

## Management of Bilious Vomiting in the Newborn Period and Radiological Support for Neonatal Services – A BAPM Framework for Practice

- If large volume and or other abdominal signs then consider holding or reducing feeds and perform an abdominal x-ray.
- If evidence of NEC then continue NBM, commence antibiotics and discuss with surgical team depending on local guidelines.
- If there is evidence of an acute abdomen refer urgently to surgical team using local pathways.
- If NEC has been excluded and bile-stained vomiting persists consider performing an upper GI contrast study to exclude malrotation.

Figure 3: Transfer for Babies (Term $\geq$ 34 weeks) with bile-stained vomiting



## Minimum Requirements for Radiological Support for Neonatal Units

### Minimum Requirements for Radiological services at a NICU (in addition to the LNU / SCU requirements) [15]

1. High quality computed or digital radiography for chest, abdominal and extremity radiography, with optimisation of exposure factors to minimise radiation dose. All neonatal X-rays should be performed by a radiographer with appropriate training and experience, and should be reported by a paediatric radiologist or a radiologist with a paediatric interest. CR & DR systems should utilise manufacturer software optimised for paediatric examinations where available.
2. Portable ultrasound scanners should be available with an appropriate range of transducers for performing cranial and general ultrasound, including Doppler, at the bedside. Operators should have appropriate training and experience for the examination which they are performing. Equipment should have regular maintenance and calibration. Special care should be taken to minimise the risk of ultrasound transducers transmitting infection between infants. Images should be securely archived and stored, preferably on a PACS, and there should be a formal report of every ultrasound examination recorded on the Radiology Information System and in the patient record. Studies performed by neonatal staff should be reported and checked by individuals competent and experienced with head ultrasound.
3. There should be access to high quality digital fluoroscopy for gastrointestinal contrast studies and other diagnostic procedures. Pulsed fluoroscopy and other dose reducing techniques should be employed whenever possible. Fluoroscopy equipment should be operated by an appropriately trained radiographer and diagnostic procedures performed by a paediatric radiologist or a radiologist with a paediatric interest.
4. There should be access to CT and MRI facilities for brain imaging. These facilities should be equipped to accommodate ventilated neonates. If these facilities are in a different hospital, systems must be in place to ensure safe transfer of critically ill neonates, who should be accompanied by appropriately trained medical and nursing staff. CT and MRI brain scans should be reported by paediatric radiologists or neuroradiologists with appropriate training and experience in paediatric neuroimaging.
  4. There should be a regular multi-disciplinary meeting with neonatologists and radiologists.
  5. There should be access to cardiac echo provision and reporting.

### Minimum Requirements for Radiological services at an LNU / SCU

- An LNU should have at least one radiologist with a sub-specialty interest in paediatric radiology formally recognised in their job plan.
- Radiology services at LNU should aim to have more than one radiologist with a sub-speciality interest in paediatric radiology so that paediatric radiology services could be provided all weekdays between 9am to 5 pm.
- There must be Sufficient radiographers to provide imaging services 24/7.
- Good quality plain radiography should be available 24/7.
- Continuous Professional Development (CPD) should take place for all imaging staff to maintain their skills in paediatric practice as a separate developmental need from CPD for adult services.
- Equipment should be optimised for neonatal use and specific neonatal imaging software

should be employed.

- Radiology services at LNU Trusts should have robust and diagnostic quality links for PACS and Radiology Information System (RIS) with SCU and NICU hospitals so that images can be shared for second opinions or for continuity of care.
- Radiology services should provide plain radiography, ultrasound services (and computerised tomography scan). Services should be established to provide fluoroscopy studies including specific pathways for contrast enhanced examination of the GI tract.
- Imaging protocols, radiation protection measures and quality assurances should be of a high standard.
- Services should **consider** providing fluoroscopy studies during all the weekdays between 9am to 5pm.
- All neonatal X-rays should be reported by radiologist within the next working day.
- There should be clearly defined escalation pathways for emergency and specialist referral
- There should be a regular multi-disciplinary meeting with paediatrician/neonatologist and radiologist.
- Neonatal network services ensure access to imaging modalities including fluoroscopy studies at LNU where it is not available locally.

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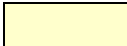





## Bilious Vomiting Parent Information

Dear Parent,

Your baby has had a green vomit. This is sometimes called **bilious vomiting**.

### What is Bilious Vomiting?

Bilious vomiting is when there is a significant (more than just a spot or two on the sheets) quantity of green (usually dark green) **not** yellow vomit. The following chart is also helpful.

True bile-stained vomit that requires immediate attention is DARK GREEN like these.		Milk
		Lemon
		Lime
		Avocado
		Pea
		Spinach

It is a fairly common problem in newborn babies and is often nothing to worry about. Sometimes the vomiting can be caused by an infection so your baby will be given antibiotics as a precaution. However, in some babies, it can be a sign that something is wrong and can be a sign of a tummy problem of some type.

### What will happen?

Most babies remain well and don't have a serious problem, but it is important that your baby is cared for appropriately and is checked to rule out some serious causes. This includes:

- Examination by a doctor.
- Some blood tests to check for infection and signs of being seriously unwell.
- An X-ray to check for blockages or other bowel problems.

The doctors will also temporarily stop your baby's milk feeds and give some intravenous (IV) (via a small tube into their vein) fluid instead until the tests are done. A nasogastric tube, a tube into the nose going down into the stomach, will also be passed. This help stop your baby's tummy from becoming distended (swollen).

### What happens after the tests?

In some babies (about 1 in 4 of babies with bilious vomiting), where there are signs of a significant problem with their tummy, it is important that they are seen by a children's surgeon to work out if they have a problem which might need an operation.

Depending on which hospital you baby has been born at, this might mean transferring your baby, by ambulance, to another hospital which has paediatric surgeons.

### Malrotation

In about 1 in 12 babies with bilious vomiting, a condition called 'malrotation' is the cause. Malrotation means that some of the bowel is in the wrong place which can mean that it becomes



twisted and blocked. This can also cause the blood supply to the bowel to be affected in a small number of babies. If the blood supply is affected this is called 'volvulus' and can be a serious problem. Most babies with malrotation have no other signs they are ill, and their x-ray can also be normal.

The only way to check for this condition is with a special x-ray called an 'upper GI contrast study'. This involves giving your baby a small amount of special dye to drink and then x-raying the tummy so that the dye outlines the bowel so that the doctors can see that it is in the correct position.

### What happens during an Upper Gastrointestinal (GI) Contrast Study?

For this test your baby will usually need to go to the x-ray department. Contrast studies usually use a thick, white liquid called barium that shows up well on x-rays. It is given with some milk usually by bottle or tube to your baby. The liquid shows up on the x-ray and shows the position of the stomach and first part of the bowel. This helps to show that the bowel is in a normal position.

The test only involves the drink and x-rays and is not painful or uncomfortable.

### What happens after the tests?

Depending on the results of the x-rays and blood tests the doctors will explain what needs to happen next. If all the tests are normal, then your baby should be able to restart their milk. They will be able to come home with you when the medical and nursing staff are happy they are feeding well enough and have finished their antibiotics.

If your baby has signs of infection on their blood tests they will usually need at least five days of IV antibiotics in hospital.

If there is a problem with your baby's tummy, it may be a condition which requires surgery or ongoing treatment from the paediatric surgeons. The doctors will explain what the condition is and what treatment is recommended.

If your baby has malrotation this usually requires an operation. This is usually a straightforward procedure but it does require an anaesthetic and your baby will need to stay in hospital for a few days. After the operation they will be able to restart their milk feeds gradually. Once it has been operated on malrotation should not cause any future problems and the operation prevents the risk to the blood supply of the bowel. Follow up with a surgeon may be organised.



# BAPM

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We are a professional association of neonatologists, paediatricians, obstetricians, nurses, midwives, trainees, network managers and other health professionals dedicated to shaping the delivery and improving the standard of perinatal care in the UK.

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