Non-bronchosopic bronchoalveolar lavage (NBBAL) for Diagnosis

PAEDIATRIC GUIDELINES

SUMMARY

- Background
- Contraindication/Precautions
- Potential complications
- Organising an NBBAL
- Preparation of the patient
- Equipment preparation
- Method
- References
INTRODUCTION

The paediatric physiotherapy department team carry out NBBAL in the acute respiratory care setting to assist in establishing aetiology of pulmonary disease in infants and children.

SCOPE

Physiotherapists who are on the paediatric physiotherapy on call rota should be familiar with the procedure and medical staff on all paediatric wards and theatres should be aware of this document.

CORE ELEMENTS

This document is to be used as guidelines and a reference for physiotherapists when carrying out a NBBAL.

REVIEW

This document will be reviewed by the acute paediatric physiotherapy team lead on a five yearly basis.
Diagnostic Non-Bronchoscopic Bronchoalveolar Lavage (NBBAL) Guideline

**Background**

Diagnostic non-bronchoscopic bronchoalveolar lavage (NBBAL) is used in the acute respiratory care setting to assist in establishing aetiology of pulmonary disease in infants and children. NBBAL has numerous clinical applications, including diagnosis of opportunistic pulmonary infections in suspected or known immune compromised infants (Caughey et al 1985, Panero et al 1995) and for mechanically ventilated children with severe respiratory failure for whom no causative pathogen has been identified and who are unresponsive to drug therapy (Biggs and Lawrance 2008, Koumbourlis et al 1993).

A variety of NBBAL techniques to obtain alveolar samples in mechanically ventilated neonates and infants have been described in published literature for more than two decades (Caughey et al 1985, Alpert et al 1992, Dargaville et al 1999, Fujitani and Lu 2006) and have been carried out by the physiotherapy team at St Mary’s Hospital for fourteen years. The safety and efficacy of NBBAL has been established (Morrow and Argent 2001). In terms of time, equipment, training and staff resources, NBBAL provides a timely and cost effective diagnostic procedure. Diagnostic yields are reported to be between 48% and 85%, with specimens comparable to those obtained from lung biopsy (Bye et al 1987, Piperno et al 1998, Koumbourlis and Kurland 1993, Morrow and Argent 2001).

**Precautions and contraindications**

Brownson et al 2007 reported contraindications and precautions for NBBAL are similar to those for any mechanically ventilated infant or child undergoing conventional respiratory physiotherapy and include:

- cardiovascular instability
- pulmonary haemorrhage
- coagulopathy
- raised intracranial pressure
- rib fractures

**Potential complications**

If there is a high risk of cardiovascular instability or the presence of other contraindications, consideration should be given to the relative risks and benefits of carrying out a NBBAL and discussed fully with the medical team. Morrow et al 2006 and Morrow and Argent 2001 report the following potential complications:

- hypoxia
- bradycardia
- bronchospasm
- haemorrhage
- increased ventilation or oxygen post procedure
- Failure to extubate / transfer to PICU
- Pneumothorax

**Organising a NBBAL**

- A senior paediatric physiotherapist who has undergone competency training and assessment by the acute paediatric physiotherapy team leader undertakes the technique.

- To request a NBBAL, bleep 1082 Monday to Friday within working hours only. Out of hours, a message can be left on the answer phone on extension x26281.
• NBBALs are carried out either on PICU or in theatres.

• Children should be either already intubated and ventilated on PICU or electively intubated for the NBBAL to be carried out in theatres. Please see Appendix 1 for guidance for NBBALs undertaken in theatres.

• Referrals are accepted from consultants only.

• Consent must be gained by the medical team caring for the patient from the parents/carers of the child prior to the procedure.

• If the child is in PICU, intubated and ventilated the NBBAL will be carried out within two hours following a request. Twenty-four hours notice is usually required for NBBALs to be carried out in theatres and it is the responsibility of the referring team to organise the theatre slot (See appendix 1).

• NBBALs requested over night or at the weekend will be carried out the following morning or on Monday and the physiotherapist receiving the referral will inform the referring clinician of this guideline. An exception to this is if the physiotherapist working the weekend is competent in carrying out the procedure. Then they may do so with the assistance of another physiotherapist or a member of the nursing team at their discretion, bearing in mind their capacity and the availability of lab analysis for samples.

Preparation of the patient

Prior to a NBBAL, the procedure should be explained to the parents and consent obtained. The child should have dependable venous access. A full respiratory physiotherapy assessment must be carried out, with particular consideration of chest x-ray findings, platelet levels and the need for adequate sedation and paralysis to ensure they do not cough during suction to allow for appropriate alveolar samples to be obtained (Brownson et al 2007). If the child's platelet level is below 50 x 10^9/1, the possible need for a platelet infusion should be discussed with the appropriate medical team prior to the NBBAL. A consultant or middle grade doctor should be present on PICU or in theatres whilst the procedure is taking place. ECG, blood pressure and pulse oxymetry monitoring should be in place.

Equipment Preparation

This technique is not sterile, but equipment should be drawn up in as clean an environment as possible to reduce the risk of contamination of samples.

The following equipment is required for NBBAL:

• Anaesthetic breathing system
• Double swivel elbow connector
• Sterile drape
• Tip of sterile glove
• Sterile scissors
• Rubber band cleaned with alcowipe
• Needle
• 5 sputum traps
• 5 BAL suction catheters (size: half the diameter of the endotracheal tube)
• 5 spigots
• 0.9% NaCl solution
• 5 syringes (size dependent on volume of 0.9% instilled per aliquot)
• alcowipe
• Clean disposable gloves
• Face mask and eye protection
A closed suction port is used so that the child can be manually ventilated throughout the NBBAL. These are available commercially; however, an adapted version is used at St Mary’s Hospital to ensure compatibility with the endotracheal tube and manual inflation circuits available on PICU (Figure 1).

It is prepared using the technique as follows:

1. Cut off a fingertip of a sterile glove and place it over the double swivel elbow connector port following removal of the plastic bung.
2. Pull tight and secure the glove with a clean elastic band
3. Pierce a hole in the centre of the port with a needle, just large enough to pass the catheter through.

![Figure 1](image1.png)
Adapted closed suction port with NBBAL catheter inserted

Using a sterile technique, 1 ml/kg (patient weight) up to a maximum of 10ml, of 0.9 % NaCl solution is drawn into five separate syringes. A maximum of 5 x 10 mls of 0.9% NaCl may be used (Schindler and Cox 1994). The syringes are then attached to the catheters using the spigots (Figure 2). The physiotherapist's discretion can be used in deciding the aliquot volume; for example, for patients who are cardiovascularly unstable smaller volumes of aliquot or reducing the number of samples obtained may be appropriate. In children with low body weight, (<10kg), an additional 1ml of 0.9% NaCl may be used per aliquot to allow for the saline which remains in the suction catheter following instillation.

![Figure 2](image2.png)
Prepared NBBAL catheters
Non-bronchoscopic bronchoalveolar lavage method

Figure 3
Closed suction port, anaesthetic breathing system and NBBAL catheter inserted

- All staff involved in the procedure must adhere to hospital infection control policy; wearing gloves, apron, mask and eye protection
- The child should be positioned depending on whether samples are required for unilateral or diffuse lung pathology. If the child is positioned in supine with their head in midline, samples from both lungs will be collected. Unilateral lung specimens may be sampled by selective cannulation of either bronchus by rotating the child’s head and positioning them in side lying with the affected lung dependent (Prasad and Hussey 1995).
- Attach the closed suction port to the child’s endotracheal tube and commence manual inflation to maintain ventilation and enable pre-oxygenation with 100% oxygen (Figure 3).
- Attach the first sputum trap to the suction unit (pressures of 60-170mmHg).
- Pass the first BAL suction catheter with the syringe connected through the closed suction port and ETT until the carina is reached.
- Stop manual inflation briefly while the 0.9% NaCl is instilled. Remove the syringe from the suction catheter and leave the catheter with the spigot attached in situ.
- Attach the sputum trap to spigot and BAL catheter, but block the suction pressure by kinking the suction tubing.
- Hold the suction catheter in place and give 2 –3 manual hyperinflation breaths.
- Apply the suction, by un-kinking the suction tubing and withdraw the BAL catheter.
- Vibrate the chest wall during the expiratory phase of manual hyperinflation, suction and withdraw the BAL catheter, aspirating as much fluid as possible.
- Recomence manual inflation once the BAL catheter is fully withdrawn, allowing time for pre-instillation vital signs to be re-gained. An alcowipe should be held over the end of the closed suction port to maintain the airway pressures inbetween samples.
- Repeat the process until all specimens required have been collected unless there are significant detrimental changes in oxygen saturations or cardiovascular status.
- If small samples are obtained, one further sample should be taken using the same technique, but at the therapist’s discretion, an increased dose of saline may be used.
- The procedure should be abandoned if there are any significant detrimental changes in SaO₂/vital signs and the medical team alerted.

The specimens should be clearly labelled and sent to the appropriate labs immediately following collection and by 2pm, except by prior arrangement with the laboratory. Specimens are sent for virology, cytology, bacterial and fungal screening

Following completion of the NBBAL, the child should receive routine PICU or ward observation by nursing staff. Patients may need increased FiO₂ or ventilatory adjustments post NBBAL, particularly those with low oxygenation indices and PaO₂/FiO₂ ratios (Morrow and Argent 2001).
References:


Fujitani S, Yu V L (2006) Diagnosis of ventilator assisted pneumonia: focus on nonbronchoscopic techniques (nonbronchoalveolar lavage, including mini-BAL, blinded protected specimen brush and blinded bronchial sampling) and endotracheal aspirates, Journal of Intensive Care Medicine, 21, 1, 17-21


Morrow and Argent (2001) Risks and complications of nonbronchoscopic bronchoalveolar lavage in a pediatric intensive are unit, Pediatric Pulmonology 32 (5) 378-84


Appendix 1

Guidance for Paediatric Non Bronchoscopic Bronchoalveolar Lavage (NBBAL)
undertaken in theatres at St Mary’s Hospital by Physiotherapists

- The procedure can be carried out by Paediatric Physiotherapists Monday to Friday (09:00 to 16:00).
- NBBAL **cannot** be carried out outside of normal working hours, the latest that the child must be in theatres is 16:00.

Prior to NBBAL (1 day + in advance of planned date)
- Haematology consultant requests NBBAL
- Haematology team are responsible for organising the GA slot:
  Contact theatre co-ordinator and anaesthetist regarding availability/booking of theatre slot on the Paediatric Emergency Lists. (Check first with the Paediatric Haematology CNS who organises the routine Paediatric Haematology list in case there is space).
- Haematology team contact the Acute Paediatric Physiotherapy Lead to request that Physiotherapists carry out NBBAL and confirm their availability:
  Physiotherapy Contact by Bleep 1082 Mon-Fri 08:45 – 17:00
  Outside of these hours a message can be left on the answer phone on Extension 26281 with the NBBAL request and the Physiotherapists will contact you the next normal working day morning to discuss.

Day of NBBAL (prior to patient going to theatre)
- Consent must be gained by the Haematology team requesting the NBBAL. The Physiotherapist can join when consent is being taken to answer any questions about the procedure at an agreed convenient time.
- The Haematology team should contact the Acute Paediatric Physiotherapy Lead on Bleep 1082 to confirm that the child remains on the theatre list and inform whether this is on the morning or afternoon list.
- The Haematology Team will confirm what specimens are required
- The Physiotherapists will set up the required equipment as per the ICHNT Paediatric NBBAL guideline in preparation for the call to theatre.
- The Haematology team will ensure that platelet levels/clotting and other clinical parameters are acceptable for the NBBAL to go ahead.
- Theatres/Haematology team will bleep 1082 to inform the Acute Paediatric Physiotherapy Lead that the child has been called to theatre.
- Theatres to confirm whether the procedure will be carried out in the anaesthetic room or theatre and whether the Physiotherapists are required to change into theatre scrubs.

In theatres/NBBAL
- NBBAL carried out as per ICHNT Paediatric NBBAL guideline.
- Labelled samples yielded are to be collected by the Haematology team from theatres handed over directly by the physios.
- It is the Paediatric Haematology Teams responsibility to ensure that the specimens are hand delivered (by a team member) or couriered to the relevant lab

Documentation
- Theatres require the Physiotherapist leading the procedure (not assisting physiotherapist) to sign the procedure book and to document the procedure on an operation note which is filed in the medical notes.

Physiotherapy Follow up
- The Physiotherapist will not routinely review the child upon their return to the ward. The Physiotherapist will identify whether the child requires physiotherapy follow up and arrange this within the team if indicated.
- Post procedure care is handed over to the Anaesthetic Team and then to the Haematology Team once transferred to the ward.
Role & Responsibilities: Paediatric Haematology Team

1. Haematology Consultant requests NBBAL

2. Contact
   a) Theatre co-ordinator and anaesthetist regarding availability of theatre slot.
   b) Acute Paediatric Physiotherapy Team Lead to request NBBAL and check availability to carry out the NBBAL (M-F 08:45-17:00 Bleep 1082, outside of these times ext 26281 answerphone for requests)

3. - Obtain consent for procedure (Physiotherapist can join if required).

4. - Ensure Platelets/clotting is acceptable for the procedure to be carried out.
   - Ensure patient is medically stable for the procedure (joint with anaesthetist).

5. - Keep the Acute Paediatric Physiotherapy Team Lead updated with any planned theatre times/changes.
   - Bleep the Acute Paediatric Physiotherapy Team Lead to confirm that the patient has been called to theatre

6. - Ensure that labels are ready for the samples.
   - Collect the samples from theatre.
   - Hand deliver or courier the samples

7. - Continue patient care after transfer from theatres.
   - Refer to Physiotherapy if further review required (the Physiotherapist will automatically arrange review if deemed appropriate)
Roles & Responsibilities: Physiotherapist

1. Upon receiving request for NBBAL in theatres, Acute Paediatric Physiotherapy Lead will check the team’s availability for carrying out NBBAL. This is dependent upon availability of staff competent in carrying out NBBAL and a physiotherapist to assist.

2. Physiotherapist will join medical team for gaining consent if required to provide additional information about the procedure.

3. Upon receiving confirmation that the NBBAL has a theatre slot. The Physiotherapist will ensure that equipment is set up as per ICHNT NBBAL guideline and ready for when the patient is called to theatres.

   - Upon receiving confirmation that the patient has been called to theatres the Physiotherapists will attend theatres with the equipment.
   - The Physiotherapists will change into

4. - The Physiotherapist will carry out the NBBAL as per ICHNT NBBAL guideline.
   - The Physiotherapist will complete all documentation in the theatre records and medical notes.

5. - The labelled NBBAL samples will be given to the Haematology team in theatres.
   - The Physiotherapist will advise and document whether the patient requires physiotherapy review after transfer back to the ward.
Roles & Responsibilities Theatres: Anaesthetist/Co-ordinator/Nurses

1. Contact Acute Paediatric Physiotherapy Lead on Bleep 1082 to advise that the patient is being called to theatre.

2. Advise the Physiotherapist whether the procedure will be carried out in the anaesthetic room or theatres and the need for the Physiotherapist to change into scrubs.

3. - Advise the Physiotherapist when the procedure can begin and assist the procedure by manually inflating ‘hand bagging’ the patient throughout the procedure.
   - Advise the physiotherapist if at any stage the procedure needs to be discontinued.

**IMPLEMENTATION**

<table>
<thead>
<tr>
<th>Training required for staff</th>
<th>Yes</th>
<th>No</th>
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| If yes, who will provide training: Please give name/post | Annette Coomer  
Acute Paediatric Physiotherapy Team Lead |  |
| When will training be provided? Please give date | As part of staff competency training for senior physiotherapists during induction to the acute paediatric physiotherapy team |  |
| Date for implementation of guideline: (after the process of ratification) | September 2014 |  |

**MONITORING / AUDIT**

| When will this guideline be audited? Please give approximate date | The use of this guideline will be monitored and reviewed annually |
| Who will be responsible for auditing this guideline? Please give name/post | Acute Paediatric Physiotherapy Team Lead |
| Are there any other specific recommendations for audit? |  |

**REVIEW**

| Frequency of review | Please indicate frequency of review:  
5 years | Person and post responsible for the review:  
Acute Paediatric Physiotherapy Team Lead |

**GUIDELINE DETAIL**

| Start Date: (date of final approval by Division) | August 2014 – Chairs Action |
| Approval Dates | Enter name of Divisional group: Paediatric Guidelines committee – chairs action  
Date of ratification: August 2014 |
| Have all relevant stakeholders been included in the development of this guideline? | Please list all (name and role):  
Dr Sabeena Qureshi Consultant Paediatric Anaesthetist  
Nancy O’Brien, CNS Paediatric Haematology |
| Who will you be notifying of the existence of this guidance? | Paediatric Physiotherapy team and members of the Paediatric Physiotherapy out of hours service  
Paediatric medical staff |
| Related documents (if applicable) | Guidance for Paediatric Non Bronchoscopic Bronchoalveolar Lavage (NBBAL) undertaken in theatres at St Mary’s Hospital by Physiotherapists (appendix 1) |
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| THIS GUIDELINE REPLACES: | Diagnostic Non-Bronchoscopic bronchoalveolar lavage Guideline 2008 |

**INTRANET HOUSEKEEPING**

| Key words | paediatric physiotherapy department, acute respiratory care, NBBAL, |
| Which Division/Directorate category does this belong to? | Paediatrics |
| Which specialty should this belong to when appearing on The Source? | Respiratory  
Therapies |

**EQUALITY IMPACT OF GUIDELINE**

Is this guideline anticipated to have any significant equality-related impact on patients, carers or staff? No