Protocol

Surveillance of post-procedure respiratory tract infections

© National Reference Center for the Surveillance of Nosocomial Infections at the
Institute for Hygiene and Environmental Medicine Charité – University Medicine Berlin

www.nrz-hygiene.de

Last updated: December 2011
Valid from January 2012
Contact information:
Nationales Referenzzentrum (NRZ) für Surveillance von nosokomialen Infektionen
(Institute director: Prof. Petra Gastmeier, MD)

Institut für Hygiene und Umweltmedizin
Charité - Universitätsmedizin Berlin

Hindenburgdamm 27
12203 Berlin, Germany

Tel.: 030/8445 3680
Fax: 030/8445 3682

and

Tel.: 049 30/ 450 570 022
Fax: 049 30/ 450 570 904

E-mail: nrz@charite.de
Homepage: www.nrz-hygiene.de
Table of Contents

1 Introduction .................................................................................................................. 4
2 General framework ....................................................................................................... 4
   2.1 Conditions for participation ........................................................................... 4
   2.2 Optional surveillance component “post-procedure respiratory infections” .... 4
   2.3 Surveillance methods ...................................................................................... 4
   2.4 Data documentation and reporting ................................................................. 5
3 Definitions for surveillance ......................................................................................... 5
   3.1 Post-procedure respiratory infections ............................................................ 5
   3.2 Documentation specifications ........................................................................ 6
4. Infection rates ........................................................................................................... 8
   4.1 Calculating the post-procedure respiratory infection rate............................. 8
   4.2 Comparing infection rates with other wards ................................................. 9
5. Data collection form for post-procedure respiratory infections .... 9
6 Pathogen codes ........................................................................................................... 12
1 Introduction

Besides patients on ventilation, patients who recently underwent surgery are especially at risk for developing a lower respiratory infection. According to the US-American National Healthcare Safety Network, 15% of healthcare-associated infections (HAI) in surgical patients were cases of pneumonia. Among thoracic surgery patients, 34% of healthcare-associated infections were pneumonia.

The development of a healthcare-associated lower respiratory infection can be prevented by measures such as rapid ambulation after surgery, adequate pain therapy and consistent breath training to improve the ventilation of lower lung sections.

2 General framework

2.1 Conditions for participation

Participation in OP-KISS with at least one indicator operative procedure is the prerequisite for taking part in surveillance of post-procedure lower respiratory infections. Surveillance must take place according to the protocol for “surgical site infections surveillance.” Surveillance of lower respiratory infections (pneumonia and bronchitis) may take place additionally and optionally for any single indicator operative procedure.

2.2 Optional surveillance component “post-procedure respiratory infections”

Interested wards may register for post-procedure respiratory infection surveillance through OP-KISS.

Surgical site infections and respiratory infections can be associated with operative procedures under surveillance. Participating wards must record for which operative procedures and in what timeframe they are performing surveillance.

2.3 Surveillance methods

All patients undergoing an indicator operative procedure under surveillance are included in surveillance (see KISS protocol “surgical site infection surveillance”) and should be actively observed for signs and symptoms of a post-procedure respiratory infection. Observation continues until the patients are discharged from hospital or up to the 30th post-procedure day.

Regular laboratory and radiology controls as well as examining patient charts are important for identifying patients infected with HAI. The less often a ward performs microbiological or radiological examinations, the more important it becomes to pay
attention to clinical symptoms. Close contact with ward personnel is therefore very important. It is recommended to ask specifically if signs or symptoms of a respiratory infection are present: pathologically relevant auscultation results, tachypnea, dyspnea, cough or purulent sputum, etc.

In general, the same surveillance framework applies as for surgical site infection surveillance.

2.4 Data documentation and reporting

The National Reference Center for Surveillance of Nosocomial Infections (NRZ, German: Nationales Referenzzentrum) provides KISS participants with an electronic system for recording and reporting surveillance data. This system can be reached online under www.webkess.de. webKess provides for documentation and transfer of locally recorded surveillance data. Every participant can evaluate their own data on their own at any point.

In order to make sure that reference data include the most recent information, KISS participants are requested to complete data transfer for any one year by 15 February of the next year.

If webKess is not available for technical reasons, it is possible to use the data collection forms found in chapter 5 of this protocol. These data must then be entered into webKess for analysis and evaluation.

3 Definitions for surveillance

3.1 Post-procedure respiratory infections

CDC definitions for post-procedure respiratory infections are used (C1a, C1b, C1c, C1d, J1). The NRZ also provides an additional definition for cases that do not fulfill CDC specifications but in which there is a strong suspicion of a respiratory infection (Cx). See 3.2 for further specifications.

A post-procedure respiratory infection is present when the infection appears in timely relation to a prior indicator operative procedure. The surveillance timeframe includes a patient’s entire stay in inpatient care from surgery to discharge. Surveillance can also end before discharge if the patient undergoes further surgery in the same surgical area or if the maximum surveillance timeframe of 30 days is achieved.

Post-procedure respiratory infections which first present after discharge or upon readmission are not included in OP-KISS. Similarly, no surveillance takes place for respiratory infections following outpatient procedures.

If a patient shows signs of a respiratory infection at the time of surgery (e.g., poststenotic pneumonia in a lung tumor operation), then a new post-procedure
A respiratory infection can only be diagnosed when the old infection is completely healed and there has been an adequate clinically free interval.

**Differentiation between respiratory infections and surgical site infections**

Infections such as an abscess or an empyema of the lung or thorax are not included in surveillance as post-procedure respiratory infections. They are to be documented as surgical site infections following procedures in this area (e.g. LOBE - lung lobectomy).

If a pleural abscess or empyema present with pneumonia at the time of diagnosis following a procedure in this area, then they should be considered surgical site infections and not a respiratory infection.

If both types of infections are diagnosed late and without a clinical free interval between them, then only the type of infection that was diagnosed first is included in surveillance.

### 3.2 Documentation specifications

If a patient included in surveillance develops a HAI according to CDC definitions, the following information has to be recorded for each infection. KISS participants must enter the data into the online data collection and evaluation system, webKess. The various fields in webKess and on the data collection form are explained below. Further required data for webKess are explained in the KISS protocol “surgical site infection surveillance.”

**KISS abbreviation:** Enter hospital and ward abbreviation on all forms! (Not required in webKess)

**Type of operation:** Enter the abbreviation of the indicator operative procedure under surveillance. (Not required in webKess). See NRZ web site for current list.

**Date of operation:** Day, month and year of operation which preceded the infection.

**webKess ID:** Identification number of the operation preceding the infection (Not required in webKess)

**Date of infection:** Date of first clinical signs of an infection, or date of sample that lead to diagnosis, whichever is earlier

**Post-procedure respiratory infection (PPRI):** C1a, C1b, C1c, C1d, J1. See 3.1

**Cx – additional criterium for PPRI:** Additional definition from NRZ for lower respiratory infections. This definition should only be used when CDC definitions are not fulfilled but there is a serious clinical suspicion of infection (e.g. treating physician’s diagnosis). If the CDC criteria are fulfilled, then the appropriate type of infection must be documented (C1a, C1b, C1c, C1d, J1).
Definition of Cx:
Thorax X-ray shows new or progressive infiltrate, consolidation, cavitation, or pneumatoceles in children under 1 year and physician begins appropriate antimicrobial therapy.

If this definition is applied, please select why CDC definitions were not fulfilled:
- 2nd radiological examination is missing/not performed
- microbiological examination missing/not performed
- symptoms are not present
- other

**Diagnosis:**
Only lower respiratory infections diagnosed during inpatient stay are included in surveillance. No post-discharge surveillance takes place. (Note: Post-discharge surveillance must still be performed for surgical site infections!)

**Mechanical ventilation:**
Select “yes” if the patient was mechanically ventilated within the 48h period prior to first signs of infection. There is no minimum duration for ventilation.
Ventilation because of anesthesia is not considered ventilation for the purposes of surveillance. However, if this ventilation is continued outside of the operation theater or the recovery room, then it should be considered ventilation for KISS purposes.

**Invasive ventilation:**
Invasive ventilation is defined as mechanical, positive pressure ventilation of a patient (controlled, assisted or in pressure support mode) at various levels of pressure in inspiration and expiration by endotracheal intubation or tracheostoma.

**Note to CPAP:** The sole utilization of continuous positive airway pressure (CPAP) is NOT mechanical ventilation and **should not be recorded as ventilation**.

**Noninvasive ventilation:**
Non-invasive ventilation is defined as mechanical, positive-pressure (controlled, assisted or in pressure support mode) ventilation at various levels of pressure in inspiration and expiration over a mask system (mouth piece or nasal, face or helmet mask) without the simultaneous presence of endotracheal intubation.

A **note on CPAP:** The sole use of continuous positive airway pressure (CPAP) is NOT considered mechanical ventilation and **should not be recorded as ventilation**.

If a patient was ventilated noninvasively and by intubation or tracheostoma (INV) within the 48h period before the first signs and symptoms or specimen collection, then the respiratory infection should be considered INV-associated.

**Laboratory**
**Proof of pathogen:**
Enter only if the pathogen seems aetiologically relevant for the lower respiratory infection. Do not enter any colonization. If there is no evidence of an aetiologically relevant pathogen or no microbiological diagnostics have been performed, enter “no” in this field.

**Note:** Enterococci, coagulase-negative staphylococci (CNS) and cornebacteria are very seldomly aetiologically relevant for lower
respiratory infections and should usually be considered colonizations.

**Pathogen 1/2/3/4:**
Field for up to four aetiologically relevant pathogens from the list.

**Material:**
Enter the type of sample in which the pathogen was found: sputum, brochoalveolar lavage (BAL)/ protected specimen brush (PSB), blood, other.

**Other**

**Secondary BSI:**
Select if a secondary bloodstream infection (BSI) appears as a complication in the surveillance timeframe of an infection being tracked within KISS. A secondary BSI is a BSI confirmed by blood culture that is related to a HAI at another body site. For a secondary BSI, the pathogen and its antibiogram must be identical to the pathogen of the primary infection. Secondary BSI are not included by themselves in surveillance.

**Patient death:**
Select if the patient died during the course of surveillance, independent of the cause of death.

**Notes:**
Space for notes. Factors relevant for internal quality management (such as patient risk factors and other situational factors) ought to be documented. The NRZ does not evaluate these notes.

4. Infection rates

4.1 Calculating the post-procedure respiratory infection rate
Infection rates for post-procedure respiratory infections are calculated separately for each indicator operative procedure. Only those respiratory infections that are diagnosed during an inpatient stay are included.

The post-procedure respiratory infection rate (RI rate) is calculated from the total number of post-procedure respiratory infections after an indicator operative procedure in a specific timeframe divided by the total number of indicator operative procedures of that type in that timeframe, multiplied by 100. The resulting rate shows how many post-procedure respiratory infections per 100 procedures of a certain type appeared within surveillance.

\[
\text{Postprocedure RI rate} = \frac{\text{Total post-procedure RI following procedure A in surveillance period X}}{\text{Total number of procedure A performed in surveillance period X}} \times 100
\]

“Procedure A” is any one specific indicator operative procedure (see list of indicator operative procedures included in OP-KISS: http://www.nrz-hygiene.de/en/surveillance/hospital-infection-surveillance-system/op-kiss/indicator-op/)
RI: Respiratory infection

*Example:*

Total post-procedure RI following procedure *Lobectomy* Jan 2012 – Jan 2013

\[
\text{Postprocedure RI rate} = \frac{\text{Total number of procedure } \text{Lobectomy}}{\text{performed from Jan 2012 to Jan 2013}} \times 100
\]

Further, the proportion of ventilator-associated RI from all RI is given as a percent.

4.2 Comparing infection rates with other wards

The infection rate described in 4.1 is calculated for each participating surgical department per selected indicator operative procedure.

A “pooled respiratory infection rate” is provided for comparison with other departments participating in KISS. This is calculated from the total number of procedures and the total number of post-procedure RI registered with KISS for a specific type of indicator operative procedure.

If the data set is large enough, it is possible to benchmark one’s own RI with the following statistical reference values:

- 25% quantile (25% of departments recording this procedure have RI rates below this value)
- Median (half of departments recording this procedure have RI rates below this value)
- 75% quantile (75% of departments recording this procedure have RI rates below this value)

5. Data collection form for post-procedure respiratory infections

If a patient under surveillance develops a post-procedure lower respiratory infection, then certain data must be recorded (see Ch. 3). The form below provides an overview of the necessary data and can be used for internal quality evaluations, or in the event that the electronic data collection system, webKess, is offline. Please use a separate form for each infection. Data transfer to the project center can only take place online.
DATA COLLECTION FORM FOR
POST-PROCEDURE RESPIRATORY INFECTIONS
OP-KISS

<table>
<thead>
<tr>
<th>Procedure information</th>
</tr>
</thead>
<tbody>
<tr>
<td>KISS Hosp. Abbr:</td>
</tr>
<tr>
<td>KISS Ward Abbr:</td>
</tr>
<tr>
<td>Date of procedure:</td>
</tr>
<tr>
<td>Type of procedure:</td>
</tr>
<tr>
<td>webKess ID:</td>
</tr>
</tbody>
</table>

Post-procedure lower respiratory infection

Only procedures diagnosed during inpatient stay are included.

**Date of infection** (first signs or sample taken):

**Infection code (CDC definitions)**
- C1a Clinically defined pneumonia
- C1b Bacterial / fungal pneumonia
- C1c Atypical pneumonia
- C1d Pneumonia in special patient groups
- J1 Bronchitis, Tracheobronchitis, Tracheitis without evidence of pneumonia

**Additional NRZ definition**
- Cx Additional definition for lower respiratory infections

**CDC definitions are not fulfilled because**
- 2nd radiological exam missing/not performed
- Microbiology missing/not performed
- Clinical documentation not available
- Other

**Risk factors:**
- Mechanical ventilation (within 48h period before infections)
- No ventilation
- Noninvasive
- Invasive by intubation/tracheostoma

**Laboratory diagnosis:** [ ] yes [ ] no

**Pathogens (max 4):**

**Sample material:**
- sputum
- BAL/PSB
- blood
- other

**Complications**

**Secondary BSI:** [ ] yes [ ] no

**Pathogen blood culture:**

**Patient death:** [ ] yes [ ] no

**Notes (not evaluated by NRZ)**

Only for patients with HAI. One HAI per form. This form can be used for internal records. Data transfer to NRZ takes place only electronically.
**Cx additional criteria for respiratory infections:**

This is a complementary case-by-case definition from the NRZ for the diagnosis of lower respiratory infections that should only be applied when CDC definitions cannot be fulfilled despite clinical suspicion of infection (e.g., physician’s diagnosis). If the CDC criteria are fulfilled, then the appropriate type of infection must be documented (C1a, C1b, C1c, C1d, J1).

**Definition of Cx:**
Thorax X-ray shows new or progressive infiltrate, consolidation, cavitation, or pneumatoceles in children under 1 year and physician begins appropriate antimicrobial therapy.

If this definition is applied, please select why CDC definitions were not fulfilled:
- 2nd radiological examination is missing/not performed
- microbiological examination missing/not performed
- clinical documentation not available
- other
6 Pathogen codes

Up to four pathogens can be documented for a single infection. The following pathogens and pathogen groups are coded as follows. For technical reasons, the abbreviations have not been translated and may therefore seem unusually different from the pathogen name.

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>S. aureus</td>
<td>SAU</td>
</tr>
<tr>
<td>Coagulase-negative staphylococci</td>
<td>KNS</td>
</tr>
<tr>
<td>Streptococcus pyogenes (A-streptococci)</td>
<td>STR_A</td>
</tr>
<tr>
<td>Streptococcus pneumoniae (pneumococci)</td>
<td>STR_P</td>
</tr>
<tr>
<td>Enterococcus spp.</td>
<td>ENT</td>
</tr>
<tr>
<td>Haemophilus spp.</td>
<td>HAE</td>
</tr>
<tr>
<td>Corynebacterium spp.</td>
<td>COR</td>
</tr>
<tr>
<td>E. coli</td>
<td>ECO</td>
</tr>
<tr>
<td>Klebsiella spp.</td>
<td>KLE</td>
</tr>
<tr>
<td>Enterobacter spp.</td>
<td>ENB</td>
</tr>
<tr>
<td>Citrobacter spp.</td>
<td>CIT</td>
</tr>
<tr>
<td>Proteus spp.</td>
<td>PRO</td>
</tr>
<tr>
<td>Serratia spp.</td>
<td>SER</td>
</tr>
<tr>
<td>Other enterobacteria</td>
<td>AEN</td>
</tr>
<tr>
<td>P. aeruginosa</td>
<td>PAE</td>
</tr>
<tr>
<td>Burkholderia cepacia</td>
<td>BCE</td>
</tr>
<tr>
<td>Stenotrophomonas maltophilia</td>
<td>STM</td>
</tr>
<tr>
<td>Acinetobacter spp.</td>
<td>ACI</td>
</tr>
<tr>
<td>Bacteroides spp.</td>
<td>BAC</td>
</tr>
<tr>
<td>Legionella spp.</td>
<td>LEG</td>
</tr>
<tr>
<td>Other bacteria</td>
<td>ANB</td>
</tr>
<tr>
<td>C. albicans</td>
<td>CAN</td>
</tr>
<tr>
<td>Other Candida spp.</td>
<td>ANC</td>
</tr>
<tr>
<td>Aspergillus spp.</td>
<td>ASP</td>
</tr>
<tr>
<td>Other fungi</td>
<td>ANP</td>
</tr>
<tr>
<td>Viruses</td>
<td>VIR</td>
</tr>
<tr>
<td>Undifferentiated growth</td>
<td>WOD</td>
</tr>
</tbody>
</table>

If SAU, ENT, ECO, KLE, ENB, PAE or STM meets the definitions below for multidrug resistance or special resistance, choose one of the following related abbreviations. Coding MDR pathogens must follow these specifications:
<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Resistant to the following antibiotic:</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>S. aureus</td>
<td>Methicillin/Oxacillin</td>
<td>MRSA</td>
</tr>
<tr>
<td>E. faecium/E. faecalis</td>
<td>Vancomycin</td>
<td>VRE</td>
</tr>
<tr>
<td>E. coli*</td>
<td>See chapter 5.4 for ESBL definition</td>
<td>ESBL_ECO</td>
</tr>
<tr>
<td>K. pneumoniae**</td>
<td>See chapter 5.4 for ESBL definition</td>
<td>ESBL_KLE</td>
</tr>
<tr>
<td></td>
<td><strong>Resistance to ≥ 3 of the following antibiotics</strong></td>
<td></td>
</tr>
<tr>
<td>E. cloacae</td>
<td>Broad-spectrum penicillins, imipenem, chinolone, aminoglycoside, cotrimoxazol</td>
<td>MENB</td>
</tr>
<tr>
<td>E. coli*</td>
<td>Third-generation cephalosporine, chinolone, imipenem</td>
<td>MECO</td>
</tr>
<tr>
<td>K. pneumoniae**</td>
<td>Third-generation cephalosporine, chinolone, imipenem</td>
<td>MKLE</td>
</tr>
<tr>
<td>P. aeruginosa</td>
<td>Piperacillin, ceftazidim, chinolone, aminoglycoside, imipenem</td>
<td>MPAE</td>
</tr>
<tr>
<td>S. maltophilia</td>
<td>Cotrimoxazol, chinolone (resistance to two antiobiotics is meaningful in this case)</td>
<td>MSTM</td>
</tr>
</tbody>
</table>

*If E. coli is both ESBL-producing and multidrug-resistant, code it as ESBL_ECO. **If K. pneumoniae is ESBL-producing and multidrug-resistant, code it as ESBL_KLE.

**Definition for ESBL**

ESBL is a resistance mechanism that is based on the production of extended-spectrum beta lactamase. *E. coli, Klebsiella pneumoniae* and *Klebsiella oxytoca* produce ESBL most commonly, but other enterobacteria such as *Proteus spp.*, *Citrobacter spp.*, and *Enterobacter spp.* may also produce ESBL.

The resistance phenotype against third-generation cephalosporine and monobactame is extremely variant between the various ESBLs. One or more substances in resistance testing may present as intermediate or even sensitive.

The microbiology lab has a special responsibility to recognize ESBL. It is not possible for clinicians to recognize ESBLs based on an antibiogram.

Only *E. coli* and *K. pneumoniae* are included in KISS as ESBL.
Legal Notice

Nationales Referenzzentrum (NRZ) für Surveillance von nosokomialen Infektionen
am Institut für Hygiene und Umweltmedizin
(Director: Petra Gastmeier, MD),
Charité-Universitätsmedizin Berlin
gemeinsame Einrichtung von Freier Universität Berlin und Humboldt-Universität Berlin
Hindenburgdamm 27
12203 Berlin, Germany
Tel.: 049 30/8445 3680
Fax: 049 30/8445 3682

Partners:
Prof. Markus Dettenkofer, MD
am Institut für Umweltmedizin und Krankenhaushygiene
(Director: Prof. V. Mersch-Sundermann, MD)
Albert Ludwigs-Universität Freiburg
Breisacher Straße 115 B
79106 Freiburg, Germany
Tel.: 049 761/270 8255/75
Fax: 049 761/270 8253

Robert Koch-Institut (RKI)
Abteilung für Infektionskrankheiten, FG 14: Angewandte Infektions- und Krankenhaushygiene
(Prof. Martin Mielke, MD)
Nordufer 20
13353 Berlin, Germany
Tel.: 049 30/4547 2233
Fax: 049 30/4547 2612

To contact OP-KISS:
Contact persons and their addresses are listed on the NRZ homepage (www.nrz-hygiene.de).

Last update: December 2011