
Structured measures against infections in nursing homes

PERSPECTIVES

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Nursing home infections are challenging with respect to both workup and choice of treatment strategy. In recent years, we have made targeted efforts in Bergen to improve the treatment of infections in nursing homes.

The chief characteristic of nursing home medicine is its diversity. Nursing home services in Bergen Municipality span from a short-term nursing home with almost a hundred beds and attending doctors on a stable daily basis, to small long-term units with doctors visiting once a week. Creating a joint platform for handling different medical conditions, including acute infections, can therefore be difficult.

At any given time, around 5 % of nursing home patients will have a bacterial infection requiring treatment. Approximately half of them have urinary tract infections (1). However, prevalence surveys record only a selection of bacterial, health care-associated infections: urinary tract infections, lower respiratory tract infections, skin and wound infections and post-operative infections. Thus there is reason to assume that the true infection burden in nursing homes is higher. Nursing home infections are also a frequent cause of hospitalisation and are associated with high morbidity and mortality (2, 3).

About 6 % of the antibiotics used for humans in Norway are administered in nursing homes, and treatment practice varies across institutions (4). The introduction of the Norwegian Coordination Reform in 2012 also sharpened the requirements pertaining to treatments offered by nursing homes. For example, a growing number of nursing homes now offer parenteral antibiotic therapy. This paves the way for increased use of broad-spectrum antibiotics outside hospitals.

The Ministry of Health and Care Services' action plan against resistance to antibiotics in the health services was presented in 2015 (5). As part of this plan, the Antibiotic Centre for Primary Care took the initiative to implement the national antibiotics intervention *Riktigere Antibiotikabruk for Sykehjem i Kommunene* [More correct use of antibiotics in municipal nursing homes] (RASK). The intervention was conducted as a pilot project in Østfold county in 2016, and in the first half of 2017 was also implemented in Hedmark and Hordaland counties. At the same time, the Department of Nursing Home Medicine in Bergen Municipality has focused on raising the quality of the workup and treatment of infections. In this article, we briefly present the characteristics of nursing home patients with infections and our approach to the subject.

Infection patients in nursing homes

In general, nursing home patients are old, have weakened skin and mucous membrane barriers and a large burden of chronic diseases, implants and other foreign bodies. They use immunosuppressive drugs more frequently than younger patients. An imbalance in the immune system's response to infections also comes with age (6). Taken together, this results in a higher risk of infection, lowered resistance and less reserve capacity for dealing with acute events.

A high prevalence of cognitive impairment and serious somatic diseases in nursing home patients attenuates the reserve capacity of important organs. As a result, we regularly observe that the prominent symptoms in acute events are due to failure of end organs and/or other functions that demand a great deal of the patient. These most frequently take the form of delirium, a tendency to fall, urinary incontinence and dehydration. A substantial share may not have fever, and some patients do not develop, or they have problems in communicating,

local symptoms of infection (7). Chronic diseases may also reduce the specificity of the clinical findings commonly associated with acute infectious diseases.

As a rule, the infection diagnosis in nursing homes is based on the clinical picture and a limited selection of cultures and inflammation markers in blood. In our experience, the classical biochemical response commonly associated with acute bacterial infections, a pronounced rise in C-reactive protein (CRP) and leukocytes in peripheral blood, may be lacking in some elderly and frail patients. Nursing home patients also have non-infectious inflammatory conditions and cancer more often than younger people, which can cause interpretation problems when there are high CRP or leukocyte values.

Elderly people can contract infections with a wide spectrum of microorganisms, and it is important to obtain adequate cultures prior to antibiotic therapy. But the incidence of microbial colonisation of the skin, mucous membranes and wounds also increases with age, particularly in the urinary tract (7). This leads to a significant risk of overtreatment with antibiotics.

Elderly people often tolerate antibiotics better than other medications. Nonetheless, they more often experience side effects and complications from antibiotics than younger people (8). In our experience, ciprofloxacin, in particular, can cause very troublesome cognitive side effects, primarily in patients with dementia. Severe renal failure also precludes the use of some groups of antibiotics such as aminoglycosides, and necessitates dose reduction of others.

Better infection management and organisation

Infectious diseases in nursing homes are rarely spectacular, but frail patients, often with unclear clinical findings, difficult workup and high morbidity and mortality make nursing home infections an important challenge with great potential for improvement. In an attempt to standardise both assessment and treatment practice at the 24, in some respects very different, nursing homes in Bergen Municipality, we have chosen to focus on systematic measures that we hope and believe can be implemented effectively.

Since 2013, medical services in Bergen nursing homes have been organised as a separate department. The management group consists of a senior consultant as head of department and three team leaders, also senior consultants, who are responsible for medical services in their individual geographical sectors. The team leader is available for telephone and local guidance in his or her sector, and is also responsible for handling any outbreaks of infection.

Departmental and team-based instruction for doctors takes place regularly, with frequent courses in infection control and infectious diseases. This arrangement encourages frequent contact between nursing home doctors and the team leader for discussions around difficult infectious disease issues and contributes to professional expertise. Along with the implementation of the

national antibiotic intervention in nursing homes, we also aim to provide nursing personnel with courses, particularly in diagnostic workup of urinary tract infections.

Use of guidelines

Nursing home doctors are encouraged to use the national guidelines for the use of antibiotics in the primary health service (which have a separate chapter on nursing home infections) and the use of antibiotics in hospitals, particularly in those cases calling for the use of parenteral antibiotic therapy. We have also developed our own methodology book on nursing home medicine with a chapter on infections that deals with general principles for workup and treatment and an account of the most common infectious diseases in nursing homes [\(9\)](#).

The national patient safety programme *I trygge hender 24–7* [In safe hands 24/7] singles out prevention of falls, malnutrition, pressure ulcers and urinary tract infections, and correct use of drugs as important areas for nursing homes to focus on. Team board meetings, at which risk tables are used to monitor different priority areas for the residents of nursing home departments, create an overview and a cross-disciplinary framework for assessing risk and necessary measures for the individual resident. A number of Bergen nursing homes have focused on prevention of urinary tract infections, with indications for catheter use as an important parameter.

Structured patient records system

In 2016, the patient records system *Geriatrisk Basis Datasett* [Geriatric Basis Dataset](GBD DIPS) was implemented at all 24 municipal nursing homes in Bergen Municipality [\(10\)](#). This records system makes it possible to structure and standardise patient records and offers considerable potential for providing an overview of antibiotics use and the infection panorama at nursing homes. In our experience, there are three areas in particular in infectious diseases at nursing homes where the precision of workup and choice of treatment strategy can be substantially improved by relatively simple means. Following implementation, the focus is now on registration, follow-up and treatment of each episode of infection (infection registration), indications for obtaining urine samples for test strip analysis or culture and decisions concerning the management of acute, systemic infections in the end of life stage.

We use an infection registration form consisting of multiple choice menus and free text (Fig. 1). This accompanies the patient through each infection episode and is updated regularly. Suspected or confirmed infection type, any microbiological findings, choice of antibiotics, if any, and outcome are recorded on the form. Nursing home doctors receive an electronic reminder to set up an infection registration form when prescribing antibiotics, and the medication list is linked to an interaction database. The infection registration form makes it

easier to monitor the course of the infection in the patient records, paves the way for customised treatment depending on the results of the microbiological tests and provides an overview of the incidence and outcomes of infections in the nursing home population as a whole.

| INFECTION REGISTRATION FORM | | |
|---|------------------|--|
| Infection type and agent | | |
| Infection type? | 3 | Urinary tract infection, lower |
| Known infectious agent? | 1 | Known agent |
| Microbes | | <i>E. coli</i> > 100 000° cfu/ml Ampicillin R, Mecillinam S, trimethoprim S, Nitrofurantoin S, Trimethoprim Sulfa S, Ciprofloxacin S |
| Antibacterial/antiviral therapy | | |
| Have antibiotics or antiviral therapy been administered? | 1 | Yes |
| Start | 01.09.2017 | 9 days ago |
| Intravenously | 2 | No |
| Medication name | | Pivmecillinam 200 mg x 3 daily |
| Outcome of infection | | |
| Start date infection | 31.08.2017 | 10 days ago |
| End date infection | 07.09.2017 | 2 days ago |
| Did the infection result in hospitalisation? | 2 | No |
| Did the patient die during the illness period? | 2 | No |
| Comments/free text | | |
| <p>Acute onset dysuria, pollakisuria and experience of reduced urine evacuation Temperature 36.8°C, respiratory rate 12 per minute, pulse 60 per minute, no confusion Tender to palpation subumbilically, no tenderness to percussion over kidney capsules Bladder scan: 500 ml residual urine Urine strip test: Leukocytes 4+, positive nitrite test Sampling method: From single-use catheter, sterile intermittent catheterisation Treatment: Empirical treatment with pivmecillinam, no need to change antibiotics according to culture results, total 7 days of treatment. Outcome: Free of symptoms on termination of treatment. No need for control urine sample.</p> | | |
| Originator | 01.09.2017 08:23 | Doctor Hans Hansen, HPR 11111 |
| Signed by | 07.09.2017 10:38 | Doctor Hans Hansen, HPR 11111 |

Figure 1 Example of infection registration form used in the patient records system Geriatrisk Basis Datasett. The form contains a combination of multiple choice menus (with numerical values in the second column), a date field (with the relevant date in the second column) and a free text field. The patient information is fictional.

Urine test strip analysis is used on broad indication in nursing homes, and probably leads to unnecessary use of antibiotics. We used a urine test strip checklist designed by the Antibiotic Centre for Primary Care as a template for an electronic checklist in the patient records system (Fig. 2). We both hope and believe that this may improve the precision of sampling and raise the threshold for the ordering of test strip analyses and urine cultures.

URINE SAMPLE CHECKLIST

| Order | | |
|--|------------------|-------------------------------|
| Ordered by doctor? | 1 | Yes |
| Background to sampling | | |
| <i>There is a relatively common belief that foul-smelling, cloudy urine indicates a urinary tract infection. However, observations of this kind are not an indication for taking a urine sample unless the patient or resident has symptoms of a urinary tract infection</i> | | |
| Burning sensation on passing water | 1 | Yes |
| Frequent passing of water | 1 | Yes |
| Recent onset of or increased incontinence | 2 | No |
| Pain in back/flanks | 1 | Yes |
| Pain over symphysis | 1 | Yes |
| Visible blood in urine | 2 | No |
| Supplement for general symptoms | | |
| New onset/exacerbation of tendency to fall | 1 | Yes |
| Fever | 2 | No |
| New onset/exacerbation of agitation/confusion | 1 | Yes |
| Reduced general condition | 1 | Yes |
| Sampling and results of urine strip test | | |
| How was the sample taken? | 1 | Mid-stream sample |
| Time of sample collection | 11.09.2017 08:30 | 2 days ago |
| Sample from first passing of water in the morning? | 1 | Yes |
| Sample collected n < 4 hours after last passing of water? | 2 | No |
| Result of urine strip test | | |
| U-leukocytes | | 3+ |
| U-nitrite | | Positive |
| U-protein | | 2+ |
| U-erythrocytes | | 1+ |
| Culture | | |
| Was a sample taken for culturing? | 1 | Yes |
| Date of sending sample for culturing | 11.09.2017 | 2 days ago |
| Background information | | |
| <i>In order to read the background information for the form, click on the «Print» icon and select «Print blank PDF form».</i> | | |
| Comments/free text | | |
| <i>Symptoms of upper urinary tract infection; indication for urine culture and empirical antibiotic therapy. See infection registration form for details.</i> | | |
| Originator | 11.09.2017 09:12 | Doctor Hans Hansen, HPR 11111 |
| Signed by | 11.09.2017 10:33 | Doctor Hans Hansen, HPR 11111 |

Figure 2 Example of urine sample checklist used in the patient records system Geriatrisk Basis Datasett. The form contains a combination of multiple choice menus (with numerical values in the second column), a date field (with the relevant date in the second column) and a free text field. The patient information is fictional.

Towards the end of life, nursing home patients often develop systemic infections, particularly of the respiratory tract, and in our experience these patients often only respond to treatment when they are offered broad spectrum, resistance-driving antibiotics. Many patients develop recurrent infections, and are often subjected to several rounds of treatment before it is decided to refrain from antibiotic treatment. Such decisions are always difficult, but as a rule, the interests of the patient and family and the perspective of antibiotic ecology are united in a decision not to administer treatment. The use of antibiotics can be included in a decision-making form in the patient records system (Fig. 3). This may inspire discussion about important decisions at a sensible stage of the illness process.

| DECISION-MAKING FORM | | |
|--|------------------|---|
| Person responsible | | |
| Person responsible/guardian | 3 | Responsible family member |
| Comments regarding authorisation | | The resident signed a lasting power of attorney with financial matters in mind in 2009. His eldest son has power of attorney. |
| Decisions | | |
| Is resuscitation to be carried out? | 2 | No |
| Can the patient be hospitalised acutely? | 2 | No |
| Will the patient donate organs? | 3 | Not known/not discussed |
| Can an autopsy be performed? | 3 | Not known/not discussed |
| Can the patient receive blood products/transfusion? | 2 | No |
| Comments/free text | | |
| <p>The resident is 94 years old, suffering from severe dementia and chronic terminal renal failure. He is therefore not to be resuscitated in the event of cardiac or respiratory arrest. Hospitalisation is to be avoided unless it is absolutely necessary to alleviate any acute complications (e.g. fractures).</p> <p>He has had recurrent respiratory infections that have been treated with broad-spectrum antimicrobial agents intravenously. He is now totally bed-ridden and takes little nourishment or fluid.</p> <p>If a new infection develops, he is not to be treated with antibiotics.</p> <p>The treatment level has been discussed with the patient's immediate family, who agree with the decisions.</p> | | |
| Originator | 01.09.2017 08:23 | Doctor Hans Hansen, HPR 11111 |
| Signed by | 07.09.2017 10:38 | Doctor Hans Hansen, HPR 11111 |

Figure 3 Example of decision-making form used in the patient records system Geriatrisk Basis Datasett. The form contains a combination of multiple choice menus (with numerical values in the second column), a date field (with the relevant date in the second column) and a free text field. The patient information is fictional.

Quality assurance

Infection prevention measures in nursing homes are particularly important, as nursing home patients have a relatively low tolerance for acute infections. In order to standardise infection prevention, a joint infection control programme was devised and implemented in Bergen's 24 municipal nursing homes in 2015–2016. The programme is available on the municipality website.

The estimated use of antibiotics at nursing homes is based on procurement data and not on consumption. We also know little about the real infection panorama in Norwegian nursing homes. National prevalence surveys show only a snapshot picture of infection prevalence and are based on reporting of clinical infection with a varying degree of precision by the individual nursing home doctors. In the future, electronic linking of real antibiotic consumption and infection registration will boost the quality assurance of infection treatment in nursing homes and pave the way for clinical and microbiological studies of nursing home infections.

Challenges associated with implementation

We applied various strategies for implementing patient record forms and infection control programme: launching lectures, reminders to nursing home doctors by email and text messages, instruction and direct communication with doctors and nursing personnel. By using these simple interventions, we have increased the use of decision-making forms. However, we still have some way to go before all the instruments mentioned above are well integrated into clinical practice, hopefully as an important contribution to improved care for nursing home patients with infections.

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