

Debate

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Methicillin-resistant *Staphylococcus aureus* (MRSA) in rehabilitation and chronic-care-facilities: what is the best strategy?

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Abstract

Background: The risk associated with methicillin-resistant *Staphylococcus aureus* (MRSA) has been decreasing for several years in intensive care departments, but is now increasing in rehabilitation and chronic-care-facilities (R-CCF). The aim of this study was to use published data and our own experience to discuss the roles of screening for MRSA carriers, the type of isolation to be implemented and the efficiency of chemical decolonization.

Discussion: Screening identifies over 90% of patients colonised with MRSA upon admission to R-CCF versus only 50% for intensive care units. Only totally dependent patients acquire MRSA. Thus, strict geographical isolation, as opposed to "social reinsertion", is clearly of no value. However, this should not lead to the abandoning of isolation, which remains essential during the administration of care. The use of chemicals to decolonize the nose and healthy skin appeared to be of some value and the application of this procedure could make technical isolation unnecessary in a non-negligible proportion of cases.

Summary: Given the increase in morbidity associated with MRSA observed in numerous hospitals, the emergence of a community-acquired disease associated with these strains and the evolution of glycopeptide-resistant strains, the voluntary application of a strategy combining screening, technical isolation and chemical decolonization in R-CCF appears to be an urgent matter of priority.

Background

Methicillin-resistant *Staphylococcus aureus* (MRSA) strains were first identified in the early 1960's [1]. They now have a worldwide distribution [2] and have evolved resistance to multiple antibiotics. The recent description of clinical strains highly resistant to glycopeptides following the acquisition of the *vanA* gene has increased fears that it will soon be impossible to treat patients infected with these

epidemic strains [3]. The prevalence of MRSA in France is among the highest in the European Union [4,5], and a recent publication by a regional surveillance network showed that this prevalence continued to increase between 1996 and 2000 [6].

Since the first half of the 1990's, most intensive care units, in which the risks associated with MRSA are very high,

Table 1: Recommendations of French CTIN for the control of MRSA

Early identification of patients colonized and/or infected with MRSA
Information of the status of the previously known MRSA positive patients at the time of hospital-to-hospital or ward-to-ward transfer
Detection of MRSA colonization and/or infection based on clinical samples
<i>Detection of MRSA carriage based on screening samples (without precision on which sites should be cultured) at admission and during hospitalisation in high risk MRSA acute care facilities or in all facilities in case of outbreaks</i>
Barrier isolation of MRSA positive patients
Technical isolation including
Compliance to hand disinfection,
Use of gloves and gowns for all contact with patients or their environment,
Use of dedicated medical equipments
<i>Geographical isolation (individual rooms) or cohorting "which considerably facilitates the application of technical isolation"</i> **
Decolonization with mupirocin associated with antiseptic daily body cleansing*

The procedures mentioned in italic are proposed by the CTIN as complementary measures and are implemented according epidemiological situation of the hospital and/or the ward

have implemented prevention measures. These measures have proved to be effective, as shown by stabilisation of the number of MRSA infections in hospitals in which the risk was increasing or by an even greater reduction in the number of MRSA infections in these units than in other types of unit in which the risk was tending to decrease [6-8]. Conversely, the situation has deteriorated considerably in R-CCF [6,9], despite the widespread diffusion of national recommendations by the *Comité Technique National des Infections Nosocomiales* (CTIN or National Technical Committee for Nosocomial Infections) [10]. These recommendations of the French CTIN, presented in table 1, were strongly recommended in acute care facilities but should be also applied in R-CCF. However, concerns were encountered when implementing these measures in this kind of departments because the mean length of hospitalisation is much longer, the ratio of patients to medical staff ratio is higher and the patients need to take part in physical and social activities, which are considered to be incompatible with isolation precautions [10-13].

The recommendations published by the CTIN target, as a matter of priority, MRSA and Enterobacteria producing extended-spectrum β -lactamases, as these bacteria are highly pathogenic and commensal, favouring their clonal spread within hospitals and raising fears for their spread in the community. The CTIN suggests that patients colonised/infected with MRSA should be identified, that these patients should be placed in isolation and that complementary measures should be implemented, including screening for carriers upon admission and during hospitalisation and treating human reservoirs (see table 1). Several questions concerning the application of these measures in R-CCF remain unanswered, notably due to difficulties evaluating the effect of any given measure within a wider strategy. Given the lack of evidence to demonstrate the efficacy of some measures and a lack of

means, the concerned establishments have implemented the recommendations of the CTIN only half-heartedly [6].

For several years, the Hygiene Department of Besançon University Hospital has placed all its means (computer facilities and biological platform) and competences at the disposal of a 120-bed chronic-care-centre (Tilleroyes Health Care Centre), with a view to controlling MRSA infections. As most of chronic-care-centers in France, the Tilleroyes Centre admitted more than 90% of elderly patients coming from acute care facilities. These patients are hospitalised approximately during 30 days and received mainly nursing cares and incidentally invasive medical cares. The aim of this article was to use the experience acquired and published data as a basis for considering the efficacy and feasibility of some of these measures, particularly those frequently contested by health professionals involved in the fight against nosocomial infections in R-CCF: screening, isolation and chemical decolonization.

Discussion

The occurrence of MRSA in rehabilitation and long-term-care-facilities

In the study carried out by the Microbiology Surveillance Network of Northern France [6], the incidence of MRSA colonisation/infection in chronic-care-facilities was 0.69 per 1000 days of hospitalisation. This incidence increased significantly between 1996 and 2000, such that it was similar to the mean observed in all types of ward and in all hospitals considered together (0.84 per 1000 days). The frequency of methicillin resistance was considerably higher than that in other types of unit (61% versus 14.4 to 42.5%). In the Franche-Comté region of France, the incidence of MRSA in rehabilitation units was 0.55 per 1000 days in 2002, which is identical to the overall incidence in all types of ward, and the frequency of resistance was practically identical to that reported in northern France

Table 2: Efficiency of screening according to the type of department

	R-LTCF ^a N(%)	Intensive care ^b N (%)
Patients positive on admission	60 (11.6)	150 (4.1)
Screened	55 (91.6)	76 (50.7)
Identified by CS ^c	5 (8.4)	74 (49.3)
Known ^d	18 (30)	30 (20)
Time to screening /CS +	ND ^e	6.7 +/- 7.3 days
Positive on discharge	62 (18.7)	ND ^e
Known	26 (41.9)	ND ^e
Screened	36 (58.1)	ND ^e

^aTalon *et al.* (14) for R-LTCF (Rehabilitation and long-Term-care Facilities) ^bGirou *et al.* (25) for intensive care units; ^cCS, clinical sample, ^dpatients previously known to be carriers, colonised or infected; ^eND, not done

(62%). Despite these figures, the direct effect of MRSA infections in R-CCF appears to be limited, given the severity of the associated morbidity. In fact, two severe infections (one case of bacteraemia and one case of deep infection) were observed in the 26 colonised/infected patients (7.7%), whereas 20.7% of the colonised/infected patients in acute-care units had severe infections (35 infections, including 16 cases of bacteraemia, 11 deep infections and eight lung infections diagnosed from samples taken during invasive interventions, in a total of 169 colonised/infected patients). However, given that patients are continually transferred between R-CCF and acute-care facilities, it is reasonable to consider these units together with all other care units and to measure the effect of MRSA on a regional health care network rather than on the scale of a given ward or hospital. If this approach is used, the rare figures available show the amplification effect of R-CCF on MRSA propagation (11.6% of patients were carriers upon admission versus 18.7% upon discharge) [14]. Several studies carried out in intensive care units have shown that the duration of hospitalisation is a risk factor for MRSA colonisation/infection [15,16]. It therefore seems logical that hospitalisation in R-CCF may amplify the spread of MRSA. Furthermore, the high frequency of "openly" colonisations/infections like urinary infections or colonised wounds, favours the spread of strains both on the hands of staff and *via* the inert environment [17-19].

Role of screening

Cookson reported that the transfer of patients between hospitals is the second most important way of increasing the risk of MRSA in a given hospital and indicated that interactions between acute-care hospitals and R-CCF may lead to the spread of MRSA in the community [20,21]. The identification of all reservoirs (colonised/infected patients and simple carriers) within wards is considered to be a major component of all control programmes [22-24] and the isolation strategies recommended to prevent cross-

transmission may be hindered if carriers are not identified upon admission. The collection of samples for screening, the usefulness and cost/benefit ratio of which remain open to debate [11,22], is indispensable both for the identification of colonised/infected patients and carriers and for the prevention of secondary infections in carriers [25]. In intensive care units, the efficacy and favourable cost/benefit ratio of setting up a voluntary strategy for the prevention of MRSA infections that involves screening have been demonstrated [25-27]. However, the efficacy of screening has also been demonstrated, in the absence of cost/benefit evaluation, in R-CCF [14]. The results with respect to the criteria for efficacy in the two types of unit (intensive care units and R-CCF) are summarised in Table 2. This table shows that for each judgement criterion for which it was possible to compare the two types of unit, a strategy including screening was even more pertinent for R-CCF than for intensive care units. Establishments with one or several intensive care units have in-house microbiology-hygiene laboratories and can screen patients at a reasonable cost. This is not the case for R-CCF, who must avail themselves of the services of an external laboratory, which is likely to be very expensive. These economic reasons dissuade hygiene professionals from implementing screening policies even though this expenditure has benefits in terms of the reduction in the number of MRSA infections and the costs associated with such infections in acute-care units.

Role of isolation

The recommendations published by the CTIN are based on both technical isolation and geographical isolation, which "considerably facilitates the application of technical isolation measures" [10]. Citing this principle and the need to "resocialise" the patient, professionals working in R-CCF often state that isolation is "not possible" in their structure and suggest a policy based only on standard precautions. The main arguments against isolation are the need to allow patients free access to the

Table 3: Incidence of acquisition of methicillin-resistant *Staphylococcus aureus* stratified according to Katz's index in a chronic-care centre.

	A	B	C	D	E	F	G
Number of patients admitted	14	13	4	10	7	11	75
Number of acquisitions ^a	0	0	0	0	0	1	5
Incidence of acquisition (%)	0	0	0	0	0	9.1	6.7

^ain patients who were not carriers (screening samples) or who were not colonised/infected (clinical samples) on admission

Table 4: Distribution of sites colonised by MRSA

	Colonised on admission N (%)	Acquired ^a N (%)
Nose	24 (9.6)	25 (10.0)
Wounds	8 (3.2)	12 (4.8)
Stools	0 (0)	1 (0.4)
Arm pits	8 (3.2)	12 (4.8)
Folds under breasts	1 (0.4)	0 (0)
Inguinal folds	1 (0.4)	2 (0.8)
Total patients	32 ^b (12.8)	47 ^b (18.8)

^aacquired MRSA whilst in hospital, ^bin total, 9 and 4 patients were positive at several sites on admission and during hospitalisation, respectively

dining room and the common room, where they meet other patients, which may result in the direct transmission of MRSA. In the case of an epidemic, it is often possible to identify reservoirs, but it is always more difficult to identify modes of transmission with certainty. Are MRSA directly transmitted from patient to patient or on the hands of the healthcare staff? It is impossible to determine accurately the part played by these two modes of transmission. However, we know that the replacement of a dressing covering a colonised wound poses a high risk of contamination for the immediate environment, including the hands of staff, because it creates an aerosol heavily loaded with bacteria [28]. It is obvious that simple contact between two patients is not associated with the same risk of transmission: the contact is less intense, the contact is with skin, which is much less densely colonised, and there is an absence of aerosols heavily loaded with bacteria. Another more direct argument comes from the non-published risk of acquiring MRSA stratified according to Katz's index, an index of autonomy [29]. According to this index, patients are classified into seven categories: from A for a totally autonomous patient to G for patients totally dependent on others for assistance with washing, dressing, using the toilet, moving around, continence and feeding (the intermediate categories are based on scores for each function, with three choices for each function: no help required, moderate help required, total help required). The study was carried out in a 120-bed chronic-care centre. Each patient was screened upon admission,

once per week during their stay and upon discharge. A patient was considered to have acquired MRSA if a MRSA was isolated from a sample taken for epidemiological or diagnostic purposes from a patient who tested negative upon admission. The results (Table 3) show that the global incidence of MRSA acquisition was 7% for classes F and G combined and 0% for classes A to E. All of this indirect evidence suggests that carriage on the hands of hospital staff plays a predominant role in cross-transmission. Thus, technical isolation rules should be respected when carrying out treatments, the efficacy of such isolation being unaffected by the mobility of patients and their "resocialisation."

Role of chemical decolonization

The CTIN suggests that human reservoirs identified by screening should be treated "with the aim of eradicating carriage". However, it recommends that care be taken to prevent the emergence of resistance to the topical antibiotics used for this indication [10]. The treatment of nasal MRSA carriage is recommended if the nose is the only site colonised or if the other colonised sites are accessible to treatment; an antiseptic wash should also be used in such cases [10]. The recommendations also include those of the Consensus Conference on the Control of multi-drug resistant bacteria in Intensive Care Units [30]. The recommended associated use of an antiseptic wash is justified by the work by Moss and co-workers and by White, Reagan and co-workers [31-33]. These authors showed that: 1)

skin colonisation is more frequent in patients carrying *S. aureus* in the nose, 2) the frequency of skin colonisation is proportional to the density of nasal colonisation and finally 3) nasal decolonization without skin decolonization led to a reduction of the density of skin colonisation. Probably due to the description of strains with low and high levels of resistance to mupirocin, which is used for nasal decolonization [34-36], the limitation of nasal decolonization to localised epidemics is recommended. This implies that isolation measures should be applied to carriers throughout the entire period of hospitalisation. This extra work load is clearly even greater in R-CCF than in acute-care facilities, as the mean duration of stay is 30 days in such units. This is often incompatible with the "availability" of healthcare staff. Furthermore, the antiseptic solutions used to clean the skin of patients, most of whom are elderly, are often considered to cause irritations or allergies on sensitive skin of patients already damaged due to prolonged bed rest. Given the "half-hearted" application of recommendations and the reluctance associated with theoretical arguments, no published studies have evaluated the role of chemical decolonization in the control of MRSA in R-CCF. In our collaboration with the chronic-care centre, independently of screening upon admission and during hospitalisation for carriage in the nose, wounds (including the drains and openings of the gastric tract), healthy skin (armpits, inguinal folds and folds beneath the breasts) and rectum (rectal swabs), it was decided to use mupirocin twice a day during five days to decolonize the noses of carriers (according to the recommendation of the manufacturer, limited to one treatment per patient) and to daily use antiseptic solution during nasal decolonisation (Biseptine™ which contain chlorhexidine) to decolonize the skin. During the six-month monitoring period in one of the two departments (60 beds), for the screening samples only, 79 of the 250 patients admitted (31.6%) were found to be colonised at one or several sites. Table 4 summarises the sites of colonisation on admission and of colonisation acquired during hospitalisation. Nasal decolonization was successful in 32 (18 patients colonised on admission and 14 patients colonised in hospital) of the 49 patients who tested positive and failed in 11 cases. For 9 of these 11 failures, another site was also colonised, this site being a wound in 8 cases. Decolonization could not be assessed in six cases, because these cases died before discharge. Fifteen of the 21 patients (71.4%) with colonised healthy skin (armpits +/- folds under breasts +/- inguinal folds) were successfully decontaminated. Four failures were observed, three of which concerned patients colonised at another site (3 wounds). Decolonization could not be assessed in two cases. Furthermore, recolonisation was observed in four patients (included in the acquired cases): all four showed nasal contamination and one of the four also had colonised healthy skin. In total, decolonization was effective

at all sites of carriage in 40 patients (50.6% of the positive patients), 19 of whom were colonised on admission and 21 of whom were colonised during their stay hospital. This made it possible to stop technical isolation measures. In no case was it necessary to stop Biseptine™ washes due to intolerance or allergy. Furthermore, at Besançon University Hospital, the large-scale use of mupirocin for long periods has not led to the appearance of resistance to this topical agent [7]. The mean time to acquisition was 11 days and the mean duration of decolonization was 9 days (decolonization: 5 days, controls carried out on 7th days and results obtained on 9th day). The discontinuation of isolation after effective decolonization made it possible to reduce the number of days of isolation to about one third (609 days compared to a theoretical total of 1853 days). Nasal decolonization appeared to be efficient in most cases, unless wounds were colonised. Is it necessary to disinfect wounds systematically? The answer to this question is unclear: the delay in healing associated with systematic disinfection and the very low level of efficacy observed do not favour this practice [19]. Once again, Biseptine™, which may carry a lower risk of delayed healing, should be tested, using various protocols to assess its efficacy.

Summary

R-CCF are at the centre of epidemics of MRSA colonisation, even if the consequences of these epidemics in terms of morbidity remain limited to them. The application of an effective prevention strategy to these departments and hospitals should considerably reduce the morbidity linked to MRSA in acute-care units. An effective strategy must be based on the identification of all reservoirs; it is therefore necessary to screen all patients systematically on admission to and discharge from these units and establishments. With this in mind, acute-care units should make their technical facilities available to these units. The isolation of patients identified as carriers, or colonised and/or infected individuals does not require the geographical isolation of these patients because the most common route of spread from patient to patient is via the hands of staff during care. Technical isolation creates extra work, which is not always compatible with the nursing time available. However, this extra work load can be limited by chemical decolonization, the efficacy of which is far from negligible. Given the increase in morbidity associated with MRSA observed in numerous hospitals, the emergence of a community-based disease linked to these strains and the emergence of glycopeptide-resistant strains, the application of a voluntary strategy including screening, isolation and decolonization in R-CCF appears to be an urgent matter of priority.

Competing Interests

None declared.

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