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Prevention of Hospital Acquired Methicillin-Resistant Staphylococcus Aureus (MRSA): Systematic Literature Review

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Received: December 16, 2020; **Published:** December 31, 2020

Abstract

This review is aiming to discuss and provide high level, clinically relevant, information on the Prevention of hospital acquired Methicillin-resistant Staphylococcus aureus (MRSA). the presented review was conducted by searching in Medline, Embase, Web of Science, Science Direct, BMJ journal, and Google Scholar for, researches, review articles, and reports, published over the past years. Were searched up to November 2020 for published and unpublished studies and without language restrictions, if several studies had similar findings, we randomly selected one or two to avoid repetitive results. Based on the findings and through our review we found varies used approaches to prevent the HA-MRSA but we highlighted the most effective and the most important approaches of prevention, pre admission screening is considered to be one of the most important method of prevention, universal MRSA screening program its show to be effective but have high cost on the health system so high risks patients screening become more feasible. On the other hand, HCW infection control practice like Hand Hygiene and universal gloves and gowns are very effective to minimize the transmission of the HA-MRSA. Additionally, to prevent the risk of the postoperative MRSA infection especially on the site of the surgical operation or in the chest antibiotic prophylaxis are strongly recommended.

Keywords: *Methicillin; Resistant; Staphylococcus; Aureus; Prevention; Hospital*

Abbreviations

MRSA: Methicillin-Resistant Staphylococcus Aureus; HA-MRSA: Hospital-Acquired MRSA; CA-MRSA: Community Acquired MRSA; LA-MRSA: Livestock-Acquired MRSA; PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses; HCW: Healthcare Workers

Introduction

Hospital acquired Methicillin-resistant Staphylococcus aureus (MRSA) is considered to be one of the major complication of hospitalization and its lead to increase the period of the hospital stay in addition to the health expenses related to that, furthermore it's associated with poor outcomes and disease prognosis [1]. worldwide incidence rate of MRSA is significantly increased during the past years [2]. MRSA is a "Gram-positive, spherical shapedpathogenic strain of bacteria in humans and animals that can cause from mild to severe infections and can even cause death cases worldwide" [3].

One of the main factor help in this increase is the inappropriate use of the antibiotics and the relationship between the antibiotics and antimicrobial resistance had been reported and there's many studies show that. Many hospitals and health care institute has adopted policies toward MRSA, however the dissemination is still increasing in most of this health care facilities [4-7].

There's two genetically different types of MRSA know as hospital-acquired infections (HA-MRSA), community-acquired infections (CA-MRSA), and livestock-acquired MRSA (LA-MRSA) for that MRSA is not just associated with the nosocomial infection it's also can cause community based infection [8,9]. MRSA is considered to be public health problem worldwide is highly prevalent in japan, united states of America and Canada, recently the spectrum of the resistance is extended to other non-β-lactams including vancomycin which indicate dangerous signs that should be raised and require public awareness [9,10].

This review presents data on the prevalence of MRSA and the prevention guidelines, to show the different approaches to prevent the dissemination of MRSA at the hospitals level.

Materials and Methods

The present review was conducted in November 2020 under the preferred reporting items for systematic reviews and meta-analyses (PRISMA) declaration standards for systematic reviews. We reviewed all the topics related to Prevention of hospital acquired Methicillin-resistant Staphylococcus aureus (MRSA)Our search was completed without language restrictions. Then we extracted data on study year, study design, and key outcome on Prevention of hospital acquired Methicillin-resistant Staphylococcus aureus (MRSA).

The selected studies were summarized and unreproducible studies were excluded. Selected data are shown in table 1.

1-	Pre-admission surveillance cultures.
2-	universal gloves and gowns
3-	Hand Hygiene
4-	Antibiotic prophylaxis

Table 1: *Show Prevention Approaches for MRSA.*

Studies have been rated as being high quality by an established evaluation process based on the DyunaMed criteria and it's based on the level of evidence as follows:

- **Level 1 (likely reliable) evidence:** Representing research results addressing clinical outcomes and meeting an extensive set of quality criteria that minimize bias. Example: Randomized controlled trial/meta-analysis.
- **Level 2 (mid-level) evidence:** Representing results addressing clinical outcomes, and using some methods of scientific investigation but not meeting the quality criteria to achieve level 1 evidence labeling. Example: well-designed non-randomized clinical trials.

- **Level 3 (lacking direct) evidence:** Representing reports that are not based on scientific analysis of clinical outcomes. Examples include case series, case reports, expert opinion, and conclusions extrapolated indirectly from scientific studies.

Inclusion criteria

Inclusion criteria were; Current methods of Prevention of hospital acquired Methicillin-resistant Staphylococcus aureus (MRSA).

Exclusion criteria

Irrelevant articles [not related to the aim of this review and articles that did not meet the inclusion criteria in this review.

Data extraction and analysis

Information relating to each of the systematic review question elements was extracted from the studies and collated in qualitative tables. Direct analysis of the studies onPrevention of hospital acquired Methicillin-resistant Staphylococcus aureus (MRSA).

Results and Discussion

Staphylococcal''people pathogens'' that can be transmit from human to human or from animals to human or vas verse, and it can colonize in different part of the human body weather in the patients or the healthcare workers (HCW) [11]. patients infected with MRSA represent the main source for the infection spreading in the hospital. In the fellow we will show the different approaches to prevent the hospital acquired Methicillin-resistant Staphylococcus aureus (MRSA) and guidelines for that and we will summarize it in table 2.

Pre-admission surveillance cultures

S. aureus carries are divided into two types the persistent nasal carriers who represent about 20% of the carriers and are intermittent carriers who represent about 30% of the carriers, since the S. aureus is considered to be virulent pathogen the rate of the transmission will be high especially from the asymptomatic carriers. To prevent the transmission of the CA-MRSA to the individuals in the hospital Society for Healthcare Epidemiology of America (SHEA) recommend the pre admission screening for the patients highly suspected to be carriers for the MRSA [12]. other studies is conducted to analyses the cost of the survey and weather to be conducted for all of the patients or for the high risk one the study show "The risk factor-based MRSA screening program screened approximately 30% of admitted patients and cost the hospital over $780 000 annually. The universal screening program screened approximately 83% of admitted patients and cost over $1.94 million dollars, representing an excess cost of $1.16 million per year. The estimated additional cost per patient screened was $17.76" [13].

Universal gloves and gowns

Olsen., *et al.* conducted study to assess the effectiveness of the gloves in reduction of the transmission of the infection found that "gloves prevented hand contamination 77% of the time and decreased bacterial counts 2 to 4 logs when compared with counts taken from the external glove surface" [14].

Study conducted to assess the effectiveness of the universal glove and gown and compare it to the effectiveness of the in hand hygiene; which found out that "Across 40 simulated replications for each factorial design point and intervention site, approximately 44% of the decrease in MRSA acquisition rates was due to universal glove and gown use, 38.1% of the decrease was due to improvement in hand hygiene compliance on exiting patient rooms, and 14.5% of the decrease was due to the reduction in HCW–patient contact rates" [17].

Hand hygiene

HCW are considered to be one of the main source for the infection transmission in the hospital since they are in regular contact with infected and carriers, since 1987 CDC emphasized the important of the Hand Hygiene after get in contact with patient and in 1996 CDC make it standard before and after any contacted with any patients.

As part of the National Hand Hygiene Initiative and study conducted to assess its effect in reduction of the infection rate in Australia the result show that "The National Hand Hygiene Initiative was associated with a reduction in infection rates in 4 of the 6 states studied. Two states showed an immediate reduction in rates of 17% and 28%, 2 states showed a linear decrease in rates of 8% and 11% per year, and 2 showed no change in infection rates" [16].

Antibiotic prophylaxis

Study show that up to 15% of patients had surgical interventions are risk for chest infection postoperatively in pancreatic surgeries, which can lead to bacteremia in about 5% of the patients, in addition to that MRSA is associated with "a 30-daymortality of about 28%to 38" after specific type of surgeries the risk of MRSA can reach up to 33% [19].

Cochrane Database system review was conducted to compare the benefits and harms of using antibiotic prophylaxis to prevent MRSA infection after surgical interventions 12 RCTs, with 4704 participants the results shows that "Prophylaxis with co-amoxiclav decreases the proportion of people developing MRSA infections compared with placebo in people without malignant disease undergoing percutaneous endoscopic gastrostomy insertion, although this may be due to decreasing overall infection thereby preventing wounds from becoming secondarily infected with MRSA. There is currently no other evidence to suggest that using a combination of multiple prophylactic antibiotics or administering prophylactic antibiotics for an increased duration is of benefit to people undergoing surgery in terms of reducing MRSA infections. Well-designed RCTs assessing the clinical effectiveness of different antibiotic regimens are necessary on this topic".

Discussion

This review is aiming to show the prevalence of MRSA and show it serious impact on the patients care outcomes and most importantly to show the most effective approaches to prevent the incidence of MRSA and its complications. In the past few decades MRSA become serious public health problem and have huge burden on the heath system, and its increase rate of incidence result in long hospital stay, health expenses. During the past years many protocols and guidelines had been published to prevent the incidence of MRSA and to increase the HCW awareness about it, and finally to eliminate the impact of the MRSA on the health systems and the population.

One of the key factors in the prevention of the HA-MRSA are the HCWs and their compliance with the protocols and the guidelines, there's many factors influence their compliance but the most important one is the awareness and the encouraging environment around them which remind the continuously about the infection control standards and the impact of this standard on the quality of the health care provided and finally it's outcomes.

Conclusion

Through our review we found varies used approaches to prevent the HA-MRSA but we highlighted the most effective and the most important approaches of prevention, pre admission screening is considered to be one of the most important method of prevention, universal MRSA screening program its show to be effective but have high cost on the health system so high risks patients screening become more feasible. On the other hand, HCW infection control practice like Hand Hygiene and universal gloves and gowns are very effective to minimize the transmission of the HA-MRSA. Additionally, to prevent the risk of the postoperative MRSA infection especially on the site of the surgical operation or in the chest antibiotic prophylaxis are strongly recommended.

Conflict of Interest

The authors of this article hasn't receive and support for this work and it was completely self-funded

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Volume 16 Issue 12 December 2020