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State of the Science Review

Infection prevention practices and the use of medical tapes

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Review

Background: Medical tapes are ubiquitous in healthcare and there are currently no guidelines for their storage and use. Tapes cannot be cleaned or disinfected; yet, several clinicians may use a given roll for any number of patients. Reports of tape contamination associated with clinical infection have been published.
Purpose: We reviewed the literature reporting microbiological studies, case reports of infections, and nosocomial outbreaks associated with the use of medical tapes and other adhesive devices to assess the prevalence of this problem.
Methods: We conducted a literature search for cross-contamination due to medical tape use in 6 databases in June 2020 using indexing terms for surgical tape, adhesive agent, adhesives or the keyword for tape. We compiled available evidence on tape contamination as a cause for healthcare-associated infections (HAIs).
Main findings: Forty-two publications reported relevant microbiological studies, case reports of infections, and/or nosocomial outbreaks. Results demonstrated that tape rolls handled with questionable practices can harbor pathogens. Some studies showed the association between contaminated tape and HAIs, which in some cases even led to death.
Conclusions: The time has come to establish national guidelines to help reduce the risk of cross-contamination from medical tapes. We offer suggested elements for these guidelines. The COVID-19 pandemic brings greater scrutiny to eliminate any avoidable cause of infection transmission.

BACKGROUND

Healthcare-associated infections (HAIs) are largely preventable. Working to reduce and eventually eliminate them will save lives and reduce costs. These infections are linked to a variety of risk factors such as indwelling medical devices, surgical procedures, injections, contamination of various surfaces in the environment, and exposure to communicable diseases from other patients and healthcare professionals. In 2008 the US Department of Health & Human Services (HHS) established a steering committee for the prevention of HAIs and developed the National Action Plan to Prevent Health Care-Associated Infections.[1] This plan focused first on acute care hospitals and later expanded to outpatient environments. Since movement of patients between care settings occurs frequently, elimination of HAIs cannot be localized to any one facility or even to a specific unit/ward within a facility. The plan also highlights ten themes for translating strategy to action, and one of them consists in achieving better use of technology, specifically stating that "improvements in medical devices, supplies, equipment, (. . .) decrease the risk of cross-infection due to contamination of the environment" (first paragraph under Achieving Better Use of Technology, page 39).

The Centers for Disease Control and Prevention (CDC)'s National Healthcare Safety Network (NHSN) is the nation's most widely used HAI tracking system. It has been collecting data for several years on specific HAIs and reports are posted online.[2] Progress has been made over time in preventing central line-associated bloodstream infections (CLABSI), catheter-associated urinary tract infections (CAUTIs), Surgical Site Infections (SSIs), Methicillin-resistant *Staphylococcus aureus* (MRSA) bacteremia, and *Clostridium difficile* infections (CDIs). These infections are relatively straightforward to track since they can be associated with specific devices, procedures, or pathogens. Another important parameter is individual susceptibility to infection due to the patient's specific health condition(s). A systematic review and meta-analysis published in 2017 identified the major risk factors independently associated with HAIs as diabetes mellitus, immunosuppression, body temperature, surgery duration, reoperation,

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cephalosporin exposure, central venous catheter days, intensive care unit (ICU) admission, length of ICU stay, and mechanical ventilation.[3] Point prevalence studies in the United States[4,5] have reported 4.0% of hospitalized patients experiencing an HAI in 2011, with this figure dropping to 3.2% in 2015.

In addition to the major causes listed above, other HAIs may occur due to factors such as accidental transmission of an infectious agent through a contaminated surface. Establishing causality and tracking these infections can be more challenging; nevertheless, clinicians are gaining awareness of the fact that microbial transmission can occur through a variety of activities in the care setting.[6] Hooker et al[7] have followed the trajectory and touch points of various objects such as trolleys, gloves, curtains, surgical tape, and many other items, and report that the complexity of practice, rather than compliance failure, often contributes to potential microbe transmission. The COVID-19 pandemic brings a whole new level of concern to these undesirable occurrences and greater scrutiny of current practices is directed at eliminating these potentially avoidable contributions to infection transmission.

Medical tape is one of the most routinely used items in the healthcare environment, providing a level of support that can range from routine and mundane to critical and life-sustaining. The myriad of touchpoints it has throughout its product lifecycle is unlike any other used in the provision of care. While the evidence surrounding its role in the risk of cross contamination has been reported on for decades, the lack of formal guidance around its use and storage highlights the lack of recognition for the important role medical tape plays in providing safe and effective care to patients.

The standard precautions for all patient care recommended in the current guidelines from the CDC state that low-level disinfection should be performed for noncritical patient-care surfaces and equipment that touch intact skin, and that noncritical patient-care devices should be disinfected on a regular basis (based on the Spaulding classification).[8] Since tape is considered noncritical AND it cannot be disinfected, by inference from these guidelines, a new single use tape roll should be used on each patient and then discarded. However, tape is sometimes used near non-intact skin, such as intravascular (IV) access sites. In this article, we focus on the potential of medical tape to be a vector of infection transmission, given its common forms and typical clinical practices. We reviewed the published medical literature to present the evidence available on this topic and to propose recommendations.

METHODS

We conducted a literature search for cross-contamination due to medical tape use in 6 databases in June 2020 through STNext. These included Medline, Embase, Biosis, Toxcenter, Chemical Abstracts and PQScitech. These have comprehensive global coverage of health, biology, nursing and chemistry academic journals. The search strategy used database specific indexing terms for surgical tape, adhesive agent, adhesives or the keyword for tape. This concept was limited to database specific indexing terms for cross-infection or keywords for cross-infection, bacterial transmission or nosocomial. Fifty-one results were identified after 47 duplicates were removed. No other limitations such as date or language were placed on the search. We only included articles in English in this review.

Both authors reviewed the articles from the literature search and additional articles identified from the bibliographies, as well as one article found in a trade journal. Additional general literature on the broader topic of HAIs was also used (outside of this specific search related to tape as a vector for infection transmission) and those articles are not included in the detailed search results below.

RESULTS

The results from the literature search included articles that were not relevant and were excluded. Figure 1 summarizes the findings.

Information from the relevant records has been organized by study type and is summarized below (in the text and in Table 1).

Studies with microbiological cultures

In vitro work using samples from clinical settings

The oldest reference identified in the literature search was published in 1974.[9] The authors suspected that contaminated rolls of tape might be a potential vehicle for bacterial transmission and conducted a study in which they cultured 24 rolls of tape at the time they came out of the manufacturer's box and at days 1, 5, and 7 after their release to the supply room of a 16-bed ICU. One roll remained in the storage cabinet as a control and it was the only roll from which no organisms were recovered. As soon as Day 1, 13 rolls of tape were contaminated, with colony counts ranging from 14 to 137. By Day 5, all 23 rolls in circulation had between 15 and >300 colony counts; overall, 11 different organisms were identified (*S. epidermidis, Bacillus* sp., *Klebsiella, S. marcescens, E. coli, P. aeruginosa, S. aureus, M. polymorpha, P. vulgaris, P. mirabilis*, and fungus). In this study, no illness or infection was documented as arising directly from contaminated tape, but this research shows that tape rolls can be a potential source of HAIs.

In a different study, Bundy[15] measured bacterial counts on tape provided pre-packaged but unsterile, comparing cultures from freshly opened rolls and from rolls that were opened and placed in a cabinet for 2 weeks. The results showed the tapes were "sterile" when freshly opened (no growth observed in culture), but after 2 weeks on the shelf, significant bacterial contamination could be detected on the smooth surfaces (*S. epidermidis, S. aureus, Bacillus species*). These results support the benefit of protecting tape with packaging to prevent its contamination. Lipscombe and Juma[32] compared bacterial growth on sterile adhesive skin closure and non-sterile 3M Micropore tape after their application to the intact skin (prepped

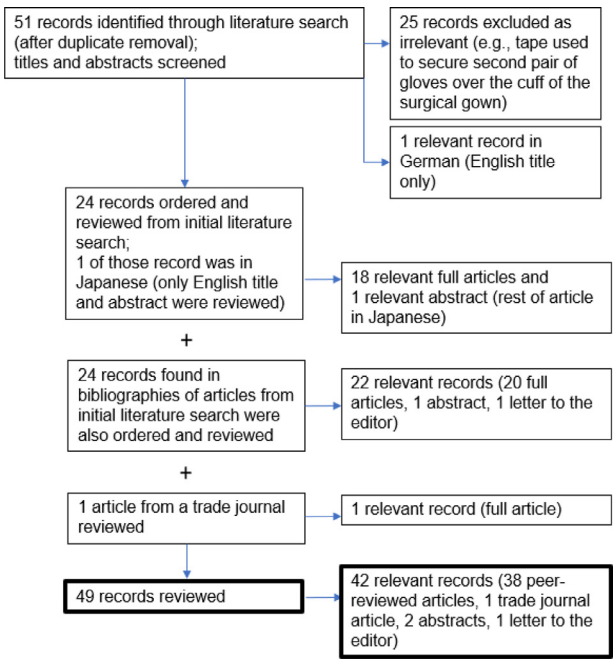

Fig 1. Findings from the literature search on the topic of tape as a vector of infection transmission.

Table 1
Types of articles identified in the literature search on contamination from medical tapes and adhesive devices

Laboratory studies with microbiological cultures		Nosocomial outbreaks	Case reports of infections under tape	Review articles	Quality improvement or observational studies
In vitro work using tape samples from clinical settings	In vitro work using tape samples from patients				
Berkowitz et al, 1974[9]	Marples et al, 1985[10]	Keys et al, 1978[11]	Aziz et al, 1984[12]	Rammaert et al, 2012[13]	Livesley and Richardson,1993[14]
Bundy, 1989[15]	Powell et al, 1987[16]	CDC, 1978[17]	Diaz et al, 1986[18]	Love, 2013[19]	Krug et al, 2016[20]
Oldman, 1991[21]	James et al, 2000[22]	Gartemberg et al, 1978[23]	Stiller et al, 1994[24]	Krug et al, 2014[25]	Lindberg et al, 2017[6]
Redelmeier & Livesley, 1999[26]	Arpin et al, 2002[27]	Bauer and Densen, 1979[28]	Hughes et al, 1995[29]		Mantyh et al, 2017[30]
Cady et al, 2011[31]	Lipscombe and Juma, 2007[32]	Everett et al, 1979[33]	du Plessis et al, 1997[34]		Spencer et al, 2018[35]
Harris et al, 2012[36]		Bottone et al, 1979[37]	Dickinson et al, 1998[38]		Hooker et al, 2020[7]
		Mead et al, 1979[39]	Alsuwaida 2002[40]		
		Dennis et al, 1980[42]	Garg et al, 2009[43]		
		Patterson et al, 1986[44]	McClusky et al, 2015[41]		
		Endoh et al, 2004[45]			
		Christiaens et al, 2005[46]			
		Lalayanni et al, 2012[47]			
		Foster et al, 2019[48]			

with chlorhexidine gluconate) of 21 healthy volunteers for 7 days. They found no significant difference in bacterial growth between the 2 products, showing that bacterial growth on skin over time under clean tape is similar to what is observed under a sterile product. Unfortunately, they did not also culture these products right after opening.

A study by Oldman[21] determined the amount of bacteria present on the adhesive and non-adhesive sides of cut tape. Different samples were tested: new roll handled with sterile gloves and sterile scissors (A), followed by handling with unwashed hands and uncleaned scissors (B), followed by handling with soap-washed hands and unclean scissors (C), followed by scissors wiped with alcohol swab (D). Both sides of the tapes (n=20 for each method) were put in contact with agar plates and incubated for 48h. With method A, 4 of 20 tapes grew 1 colony-forming unit (cfu) (*S. epidermidis*) on the adhesive side and 1 of 20 on the non-adhesive side. With all other methods, all tapes grew multiple cfus on both sides (from 6 to 596 cfus; DNase-negative *Staphylococci, S. aureus, P. aeruginosa*, gram-negative *cocci, Bacillus* species). This study also demonstrated that bacteria can permeate through the tape if the non-adhesive side becomes wet. This work included a survey of nursing students which confirmed that adhesive tape was often stored unwrapped, on open racks, shelves, drawers, IV trays, and pockets, highlighting high potential for contamination when such tape is used to secure IV cannulae.

Redelmeier and Livesley[26] examined the rates of contamination for rolls of adhesive tape (3M Transpore) obtained in a large hospital. They looked at new rolls from unopened boxes (24 specimens; 0 contamination), used rolls from patients with IV lines (24 specimens; 22 contaminated), and rolls already open around the hospital, e.g. from IV equipment baskets, desktop surfaces in wards, or by asking someone to lend a roll of tape (80 specimens, 59 contaminated). They also looked at the effect of removing the outermost layer from partially used rolls and culturing the next layer (42 specimens, 2 contaminated). Organisms were diverse (coagulase-negative and coagulase-positive *Staphylococci, Bacillus* species, alpha hemolytic *Streptococcus*), some rolls had polymicrobial growth, and the most common bacteria was coagulase-negative *Staphylococci*. The authors concluded that adhesive tape may transmit pathogenic bacteria that contribute to infections and that discarding the outer layer might reduce the risk.

A small pilot bench study was initiated by Cady et al[31] after a survey of 200 healthcare providers indicated that 67% of respondents use non-sterile tape initially on peripheral catheters, followed by a sterile dressing over the catheter/tape apparatus. The authors cultured the following types of samples for 3 days: 1) control: sterile transparent dressing (3M Tegaderm), 2) unused, new non-sterile surgical tape rolls, and 3) previously used non-sterile surgical tape rolls. This was done in 2 arms (sterile setup and nonsterile approach, i.e. worst-case clinical scenario). All controls (Group 1) showed no growth, except the touched edges of the sterile dressing in the non-sterile testing approach), but in Groups 2 and 3 there was growth along nearly every piece of tape (more so with the previously used tape and with the nonsterile approach). Species identified were coagulase-negative *Staphylococcus*, *Micrococcus*, *Diphtheroids*, *Viridans streptococcus*; *Fusarium*, *Bipolaris*. The authors then suggest a 5-step method to secure IV catheters that involves placing a transparent, sterile dressing over the hub before other securing steps.

Harris et al[36] performed cultures on 21 batches (up to 3 tapes per bag) of surgical tape rolls and reported that all batches showed evidence of bacterial contamination, and 11 of the 21 batches tested positive for MRSA and/or vancomycin-resistant *Enterococcus* (VRE), demonstrating that surgical adhesive tapes are frequently contaminated with multiresistant organisms. This study did not look for a relationship to clinical infection, however, the authors conclude that short rolls of surgical adhesive tape should be supplied in sealed packets and used for individual patients after hand disinfection and discarded after use.

These microbiological studies have repeatedly demonstrated that rolls of tape can harbor pathogenic bacteria and are therefore cause for concern. Table 2 summarizes the microorganisms cultured from tapes in the studies listed.

In vitro work using samples from patients

Marples et al[10] intended to see if adhesive tapes applied to babies in a special care unit were a potential reservoir of pathogenic strains leading to infection of the baby or dissemination to other babies. The authors performed semi-quantitative sampling of 37 taped sites and 37 matching control sites in 30 babies; results showed a tendency for bacterial growth under the cardiac monitors or the occlusive plastic adhesive tape to be greater than at the control site in 24 of the 37 babies. Counts $\geq 10^5$ were recorded 11 times under tape but in only 2 control samples, and the counts of potential pathogens differed even more, with up to 7×10^5 *Candida albicans* at the tape site when the control site yielded only 80 counts. An outbreak of infections caused by *Candida albicans* occurred during the study, although it was difficult to demonstrate that the use of tape contributed to it. A different study[16] in a neonatal ICU looked at the prevalence of *Malassezia furfur* (yeast) skin colonization. Using microbial cultures once per month, 506 cultures were obtained for 361 patients over one year. Several factors were significantly correlated with colonization, including the

Table 2
Microorganisms cultured from tapes in the various studies identified in the literature search

Microbial species identified on tape	Reference
S. epidermidis	Berkowitz et al, 1974[9]; Bundy, 1989[15]; Oldman, 1991[21]
Bacillus sp.	Berkowitz et al, 1974[9]; Bundy, 1989[15]; Oldman, 1991[21]; Redelmeier and Livesley, 1999[26]
Klebsiella	Berkowitz et al, 1974[9]
S. marcescens	Berkowitz et al, 1974[9]
E. coli	Berkowitz et al, 1974[9]
P. aeruginosa	Berkowitz et al, 1974[9]
S. aureus	Berkowitz et al, 1974[9]; Bundy, 1989[15]; Oldman, 1991[21]
M. polymorpha	Berkowitz et al, 1974[9]
P. vulgaris	Berkowitz et al, 1974[9]
P. mirabilis	Berkowitz et al, 1974[9]
Fungus	Berkowitz et al, 1974[9]
DNase-negative *Staphylococci*	Oldman, 1991[21]
gram-negative *cocci*	Oldman, 1991[21]
coagulase-negative *Staphylococci*	Redelmeier and Livesley, 1999[26]; Cady et al, 2011[31]
coagulase-positive *Staphylococci*	Redelmeier and Livesley, 1999[26]
alpha hemolytic *Streptococcus*	Redelmeier and Livesley, 1999[26]
MRSA	Harris et al, 2012[36]
VRE	Harris et al, 2012[36]
Candida albicans (yeast)	Marples et al, 1985[10]
Micrococcus	Cady et al, 2011[31]
Diphtheroids	Cady et al, 2011[31]
Viridans streptococcus	Cady et al, 2011[31]
Fusarium (fungi)	Cady et al, 2011[31]
Bipolaris (fungi)	Cady et al, 2011[31]
Malassezia furfur (yeast)	Powell et al, 1987[16]
Aspergillus flavus	James et al, 2000[22]
B. fragilis	Arpin et al, 2002[27]
Rhizopus	Keys et al, 1978[11]; Gartemberg et al, 1978[23]; Bauer and Densen, 1979[28]; Everett et al, 1979[33]

number of days with paper tape use and occlusive tape use (other factors were younger gestational age, lower birth weight, longer hospital stay, more incubator days, more lamb wool days). When looking specifically at patient care items used, there were significant correlations between mean days of use and colonization for four of 22 items analyzed. Two of the four items were tapes.

Another study[22] described a molecular analysis method to type various isolates of *Aspergillus flavus* to see if a cluster of infections were related. Two cases from a NICU, where both infants were transported by the same ambulance and crew on the same day, showed the same genotype of *Aspergillus flavus*, and that same strain was also found on a roll of tape used to fasten their umbilical catheters, on a canvas bag used to store the tape in the ambulance, and on the tape tray in the ambulance isolette. In addition, a 4-year old child treated at the same medical center during the same week had an infection from the same strain. The authors conclude that the implications of the study underscore the need to avoid the use of such nonsterile items in hospital units housing patients at high risk for the development of invasive fungal infections.

Genotyping methods were also used in a study[27] reporting a cluster of 4 cases of *B. fragilis* bacteremia where 2 cases came from cross-contamination from one of the 2 original independent cases. The adhesive bandage used in the operating room to fix the implantable venous port in one patient and the Huber needle in the other patient was speculated to be the source of cross-transmission. These authors also demonstrated that this strain of *B. fragilis* remained viable on the adhesive tape for at least 8 hours when present at levels higher than 10^6 cfu/ml.

Nosocomial outbreaks

Several publications starting in the 1970s reported nosocomial outbreaks or case reports of *Rhizopus* infections associated with Elastoplast products.[11,17,23,28,33,37,39,42,44,46] Two of these publications report fatal outcomes (one patient each).[23,44] Investigations by the FDA and the manufacturer later confirmed *Rhizopus* species in culture of the product and in environmental samples taken in the plant.[11] Although the microorganism did not originate in the hospital in these cases, these articles confirm that contaminated adhesive products such as tapes and dressings can transmit infection to patients. Rammaert[13] published in 2012 a review of all the cases of mucormycosis attributed to healthcare procedures between 1970 and 2008. A total of 169 cases were studied (121 of which were after 1990, i.e. 72%). Skin was the most common location (57%). *Rhizopus* was the most frequent genus (43%). Infection portal of entry included surgery and presence of medical devices such as catheters and drains, adhesive tapes and bandages, and intravascular devices. The authors discuss the fact that the incidence of mucormycosis has increased in the 20 years prior to their publication, in part due to the increasing use of immunosuppressive drugs. The first line therapy is amphotericin B with aggressive surgery. It is noteworthy that the overall mortality rate was 50%, emphasizing the importance of preventing these infections in the first place. Most cases occurred in very sick patients but also occasionally in patients with no predisposing conditions.[39]

Case reports

The literature search also identified several case reports of bacterial or fungal infections under tapes used to secure various devices. Each of these reports may have been perceived as anecdotal descriptions of rare cases at the time they were published, but taken together, they illustrate the growing evidence over time that serious infections can occur due to devices typically seen as innocuous. Necrotic lesions due to mucormycosis were noted under adhesive tape holding endotracheal tubes.[12,38,40] Phycomycosis (fungus infection of the orbit) was reported in two patients, with the primary lesion located under the adhesive tape used to fix their nasogastric tube to the skin.[18] Another fungal infection (cutaneous zygomycosis) was reported under the tape used to secure a nasogastric tube; the authors describe zygomycosis as a "rapidly progressive infection which may be fatal in a few days if not treated" (page e510, 2nd paragraph).[43]

In addition, case reports commenting on infections suspected to be related to tapes (but where tapes were not cultured, or indirect or inconclusive results were obtained) have been published.[24,29,45,47,48] For example, a premature infant developed an infection at an abrasion on the abdominal wall "most likely caused by removal of an adhesive patch used to cover the temperature probe" (page 179, Case Report, 3rd paragraph), which developed into fatal zygomycotic necrotizing cellulitis.[34] The gravity of this case highlights the importance of this potential risk and the possible consequences in fragile, compromised patients.

DISCUSSION

Evidence

Our review of the literature indicates that medical tape has been a suspected vector of infection transmission for decades and yet the practice has not changed substantially. As described by Redelmeier in 1999,[26] adhesive tape is a unique piece of medical equipment for several reasons: it is not washed or sterilized after initial opening; a given roll may be used by several clinicians on multiple patients; it is frequently manipulated using ungloved hands; and it can be applied

in close contact to intravascular insertion sites. In addition, tape can strip skin when repeated applications and removals are needed, further increasing the risk of infection since the skin barrier protection is damaged. Patients who are at increased risk for infection due to their health condition(s) are particularly vulnerable.

The practice around tape has started changing with the Centers for Medicare & Medicaid Services guidance for hemodialysis patients issued in 2008,[49] stating that "Tape rolls must be dedicated to a single patient, or disposed of after patient use" (Federal Register Vol 73, No 73, page 20376, middle column). Hemodialysis patients are recognized as being immunosuppressed and thus have a higher susceptibility to infections in general. They are also at increased risk of more severe infections. Love (2013)[19] also advocates dedicating a roll of tape to a single patient if they are at high risk. However, it would be reasonable to apply similar infection control precautions to all patients on whom tape is used.

Another common practice examined by Krug et al[25] is the securement of endotracheal tubes with adhesive tape. These authors reviewed the literature from 1974 to 2013 and identified many elements of infection risk related to this procedure: Nonsterile adhesive tape is cut and adhered to the anesthesia gas machine (it will then be used to secure the tube to the patient's face); anesthesia providers are often noncompliant with hand hygiene (82% of the time) and harbor pathogens on their hands (66 % of the time), then apply tape to a patient using their hands; the roll is then returned to a supply bin for use on other patients; the tape can drop to the floor, be retrieved and reused. The authors describe this practice as unsafe and suggest that a better practice would be to have a single-patient, individually packaged roll of tape for this application. The same group published a study two years later[20] in which 18 anesthesia providers accepted to change their practice by using one of two tapes that met the criteria (single-use and individually packaged: ET Tape and Hy-Tape) and using the specific taping practice presented. In addition, they read an evidence-based article about the impact of taping endotracheal (ET) tubes on patient safety and filled out a questionnaire before and after. The providers involved changed their perceptions about the taping practice because of an increase in awareness. A change in practice can happen when the best and most current evidence is presented.

Interestingly, a few articles described the use of tape to remove surgical site hair after clipping; one mentioned that several respondents reported noticing contamination of the tape roll used for hair removal.[30,35] This illustrates an example where tape is creatively used for a purpose other than for what it is intended and can once again become a vector for infection if it has time to collect environmental microorganisms prior to its use. Finally, a few articles were identified in which tape was used as a collection device to sample microorganisms from various environments suspected to be contaminated.[50,51] This last example does not constitute a risk of contamination for patients but confirms that microorganisms do adhere and survive on tape.

Clinical implications and proposed solutions

While caring for patients in an increasingly complex environment, clinicians adhere to recommendations and guidelines currently focused on the most obvious risks of contamination, such as hand hygiene and environmental surfaces. Other less obvious environmental risks may be overlooked. There may be no greater evidence of this unintentional oversight than the storage and use of medical tape. Guidelines and recommendations from reputable organizations remain one of the key factors in driving practice change. While the CDC Guidelines recommend standard precautions for all patient care that includes low-level disinfection of noncritical items that touch intact skin and at a minimum items that are visibly soiled be disinfected on a regular basis,[1] there are no specific guidelines regarding the storage and use of tape. Tape often makes its way through the care setting via clinician pockets or on stethoscopes and is stored in areas that are often not routinely cleaned. The tape is then subsequently used in the treatment of multiple patients. Increased demand for single-patient use products has emerged as central to infection control practices, however tape continues to be one of the only items still used on multiple patients. As previously reported by McClusky et al,[41] a survey completed at a 2014 Michigan Society for Infection Prevention and Control Spring Conference noted 64% of clinicians do not dedicate rolls of tape to a specific patient, nor do they discard used tape rolls when a patient is discharged 57% of the time. Those multi-use rolls of tape are then taken from patient to patient and room to room where they can serve as a vector for transmission between compromised patients. Unsurprisingly, 100% of clinicians surveyed reported that their institution has no policy or standard of care for how tape is stored.

As noted earlier in this review, hemodialysis patients remain the only population with specific guidance on how tape should be used within their course of care; however, the COVID-19 pandemic has given rise to greater concern for the maintenance of optimal infection control practices for all individuals, including healthcare professionals. It is reasonable to conclude that all patients and healthcare professionals should be considered at risk of infection. All patients should benefit from the same infection control precautions applied to dialysis patients. Most other items used in the care setting come in a package, including items such as hair combs. It would be inconceivable to carry in a pocket an unpackaged securement dressing and apply it on an IV site. Similarly, it should not be considered acceptable practice to transport and use medical tape in such a manner.

Clinical practice guidelines for medical tape use, application, and storage to reduce the risk of cross-contamination are long overdue. Specific guidance regarding medical tapes should be included in the next updates to existing guidelines. In the interim, healthcare facilities can improve practice by taking the following simple actions and formalizing them in their standard policies and procedures:

- Tape rolls should be individually packaged to help reduce potential exposure to environmental contaminants, facility surfaces and equipment, as well as the hands of healthcare professionals;
- All tape rolls, regardless of length, should be individually packaged for single use on a single patient;
- Unpackaged tape should not be kept in pockets or on stethoscopes;
- Tape should be stored in a clean storage or utility room with established cleaning schedules and in the manufacturer's packaging;
- Tape found unpackaged is potentially contaminated and should be disposed of. Conversely, the presence of intact packaging confirms that a new roll is being used.

With the availability of individually packaged single-use length medical tapes, implementation of these recommendations can be easy and straightforward.

CONCLUSIONS

Medical tape is ubiquitous and widely used in the health care setting due to its utility in performing a variety of clinical tasks. Many published case reports point out its role in infectious disease transmission, enabled by storage, handing, and usage practices. Observed practices include carrying tape in clinician pockets and on stethoscopes, storing unused portions in areas that are often not routinely cleaned, and using the same roll in the treatment of multiple patients. Comprehensive clinical practice guidelines with recommendations on medical tape storage, handling, use and application are needed to

reduce cross-contamination and HAIs. The emergence of new pathogens such as SARS-CoV-2 brings a new urgency to this topic. The solutions proposed in this article to improve handling of one of the most widely used items in healthcare should be given due consideration.

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