

Adhesive Tape and Intravascular-Catheter-Associated Infections

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Adhesive tape is placed in close contact with intravascular catheters for extended periods and could theoretically contribute to local infections. We found that 74% of specimens of tape collected in one hospital were colonized by pathogenic bacteria. However, only 5% of specimens had significant growth from an inner layer obtained by discarding the outside layer from each roll. We suggest that adhesive tape is a potential source of pathogenic bacteria and that discarding the outer layer from a partially used roll might be a simple method for reducing the risk of infection to patients.

KEY WORDS: intravascular catheter infection; adhesive tape; nosocomial disease.

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Intravascular catheters provide a method for delivering fluids, medications, and nutrition to patients; however, they are also a source of infection. About 50% of hospital patients require intravenous access,¹ from whom 1% to 10% of catheters eventually become contaminated.¹⁻³ The most common consequence is phlebitis, occurring in 64% of patients with colonized catheters compared with 13% of control patients with noncolonized catheters.³ The most serious consequence is sepsis, occurring in about 1 per 3,000 cases involving peripheral catheters, which can be complicated further by metastatic infections.^{4,5}

Adhesive tape is a unique piece of medical equipment because it is almost never washed or sterilized after initial opening of the package. In addition, a roll of tape may be used by and for many individuals and thereby become exposed to several patients and clinicians. Moreover, a roll is typically manipulated by a doctor, nurse, or other health care worker using ungloved hands. Finally, adhesive tape is applied in close contact to the intravascular insertion site for extended periods.

We hypothesized that a roll of adhesive tape may become colonized by organisms and contribute to intravascular catheter infections. Other studies have shown contamination in stethoscopes,⁶ otoscopes,⁷ thermometers,⁸ nurse's scissors,⁹ doctor's pens,¹⁰ and coffee cups¹¹ (also see Felix C. Sanitation and Family Health Update. Single Service News. Jan-Feb 1992; www.fpi.org/bugsmugs.htm).

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The hands of medical personnel are notorious, with colonization rates much greater than those of controls.¹²⁻¹⁵ This study examined the rates of contamination for rolls of adhesive tape obtained in a large hospital.

METHODS

The tape studied (3M Transpore) was chosen because of its popularity at our hospital. We obtained new tape specimens from unopened boxes in the central stores department (negative control group) and used tape specimens from patients with intravenous catheters who were scheduled to have a change as part of their usual care (positive control group). Specimens from already opened tape rolls were obtained from partially used rolls in the hospital (active group). Finally, a fourth category of tape was obtained by discarding the outermost layer from partially used rolls and culturing the next inner layer (modified group).

Rolls of adhesive tape were collected on separate days from convenient hospital locations during January 1998. Specimens were acquired by taking rolls out of intravenous equipment baskets, from around desktop surfaces on wards, or by asking someone to lend a roll of tape. In most cases no questions were raised; if confronted, the experimenter claimed he was "testing the tape for stickiness." Rolls were handled through the central hole and sealed in numbered bags for transportation.

In the laboratory, each roll was unrolled three fourths of a revolution (about 10 cm) and cut using preflamed scissors. A 2-cm length of tape was then imprinted, non-sticky side down, for about 10 seconds in contact with the Columbia 5% sheep blood agar medium on a petri dish. To test the reliability, a second specimen was cut from a noncontiguous 2-cm length and analyzed by the same methods. All petri dishes were incubated in ambient air at 35°C for 1 day and examined by a technologist blinded to tape origin.

RESULTS

No tape from the negative control group showed growth (0 of 24 specimens). Almost all tape from the positive control group showed growth (22 of 24 specimens). Active rolls had significant growth in most cases (59 of 80 specimens). Rates of tape contamination were similar in different parts of the hospital, with the emergency, nephrology, and hematology/oncology wards having the highest levels of contamination (Table 1). First and second specimens from each roll showed similar results (identical in 90% of pairs), and the colonies were too numerous to count in 24 of 59 specimens.

Table 1. Source of Tape

Source (n)	First Specimen Contaminated, %	Second Specimen Contaminated, %
Hospital location		
Emergency department (4)	100	100
Intensive care unit (4)	100	75
Coronary care unit (4)	75	50
Surgery recovery room (4)	50	50
General surgery ward (4)	50	75
General medicine ward (4)	75	75
Hematology/oncology ward (4)	100	100
Nephrology ward (4)	100	100
Orthopedic surgery ward (4)	75	75
Vascular surgery ward (4)	0	50
Negative control		
Fresh unopened container (12)	0	0
Positive control		
Patients with intravenous catheter (12)	92	92

Organisms were diverse, and some rolls showed polymicrobial growth. Coagulase-negative staphylococci were the single most common bacteria (Table 2). The general distribution of organisms observed was similar but not identical to the distribution of organisms cultured in a classic study of the causes of intravascular-catheter-related sepsis.⁴ The most notable differences were the relatively higher rates of coagulase-negative staphylococci and relatively lower rates of *Staphylococcus aureus* in our study.

Removing the outermost layer and culturing the next inner layer yielded different results. Specifically, 2 of the 42 specimens from the inner layer showed colony formation compared with 59 of the 80 specimens from the outside layer ($p < .001$). One intensive care unit specimen grew coagulase-negative staphylococci, and one orthopedics ward specimen grew gram-negative bacilli. In both cases, only a single colony was apparent, and it was only on the outside edge position.

DISCUSSION

We found significant bacterial growth on the outer layers of rolls of adhesive tape obtained at one hospital. We also found that tape from the next inner layer rarely showed growth. Together, these results indicate that adhesive tape may transmit pathogenic bacteria that contribute to infections. Furthermore, the findings suggest that discarding the outer layer from a partially used roll of tape might reduce the risk of infection.

Our work focused on one potential contributor to intravascular catheter contamination; however, many other

Table 2. Analysis of Microbiology*

Organism	First Specimen, % (n = 40)	Second Specimen, % (n = 40)
Coagulase-negative staphylococcus	72.5	72.5
Coagulase-positive staphylococcus	0	2.5
Gram-negative bacilli	5	15
Alpha hemolytic streptococcus	5	17.5
Bacillus species	5	0
No growth	27.5	25

*Percentages may sum to over 100% because of polymicrobial growth.

factors are also important. In particular, an extended duration of catheterization, concurrent infection, poor insertion technique, and improper catheter care are established risk factors.¹⁶ The use of a sterile method is important, as is the cleanliness of the insertion site.¹⁷ The safest type of dressing remains controversial.¹⁸

Our study has limitations. The sample size was small. We did not directly examine infected catheters, and we evaluated only rates of colonization. Moreover, different brands of adhesive tape could differ in their support of bacteria. We did not test for fungi, viruses, or anaerobes; however, others have reported no growth of such organisms on surgical tape.¹⁹ Finally, analyses for the duration of bacterial survival and for reservoirs of resistant organisms remain topics for future research.

These limitations imply that practitioners must use judgment when deciding whether the theoretical risks justify extra precautions. In particular, whether the outer layer of a roll of adhesive tape should be discarded and only the inner layer applied to secure intravenous catheters. Moreover, similar considerations may pertain to other procedures in which adhesive tape is applied, such as in securing endotracheal tubes or wound dressings. Finally, physicians and nurses may want to reconsider their own willingness to lend a colleague a roll of tape.

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