

# Blood contact and exposures among ambulatory surgery personnel

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This paper describes the risks of blood exposure to healthcare workers in ambulatory surgery. Circulating nurses observed and asked personnel about blood contact and exposure, and recorded data on 376 consecutive ambulatory surgery cases in a community hospital. Contact with blood occurred in 11 cases (2.9%); two punctures occurred (0.5%). Orthopaedic surgery was associated with blood contact (odds ratio 5.9, 95% confidence interval 1.4-24). Punctures occurred during injecting or suturing. Contact with intact skin was most commonly to legs and feet, through protective clothing strikethrough. Rates of exposure are lower than those in studies of inpatient surgeries, but this remains an area of risk to healthcare workers and needs further study.

**Key words:** Ambulatory surgery, bloodborne pathogens, occupational health

Researchers have identified operating room personnel as having a high risk for blood exposure. From early general studies of occupational bloodborne exposure risk<sup>1-3</sup>, specific research in the operating room has identified categories of personnel, types of surgery and certain activities that are associated with blood contact<sup>4-9</sup>. However, to our knowledge, this is the first report of such data from a hospital ambulatory surgery department.

Research available on exposure to blood in inpatient operating rooms has shown a wide range of exposure rates, because of differences in (1) the definition of exposure, (2) in methods to determine that an exposure has occurred, (3) in surgeries performed in the study sites, and possibly (4) in the effectiveness of preventive strategies. Gerberding and her colleagues used circulating nurses as observers to study all contacts with blood, including puncture, mucous membranes, non-intact and intact skin, but included contact with other body fluids as well as those with blood in their definition of exposure<sup>4</sup>; they found a parenteral exposure rate of 1.7% and cutaneous exposure rate of 4.7%. Popejoy et al. used circulating nurses as observers, and found a 2.2% rate of punctures, calculated as the number of person-procedures per total number of surgeries<sup>5</sup>. Panlilio studied

all contact with blood, using dedicated observers, and found that contact occurred in 30.1% of all surgeries, with a 4.9% rate of punctures<sup>6</sup>. Quebbeman and his colleagues, using dedicated operating room nurses as observers, reported that 50% of surgical procedures involved contact with blood, and cuts or needlesticks occurred in 15% of the operations<sup>7</sup>. Tokars and his colleagues used trained observers and reported percutaneous injuries in 6.9% of surgeries<sup>8</sup>.

The methods differed but the risk factors that emerged were similar. Risk of exposure increased with the length of surgery<sup>4,6,7,9</sup>, was associated with job classification as a surgeon<sup>6-9</sup>, type of surgical procedure or surgical speciality, in particular vascular procedures and intra-abdominal gynaecologic procedures<sup>4</sup>, trauma, burn or orthopaedic emergency procedures<sup>6</sup>, vaginal hysterectomy<sup>8</sup> and thoracic surgery<sup>9</sup>. In all reports of inpatient surgeries, the conclusions were that accidental contact with blood occurred regularly, and all surgical personnel were at risk of contact. Although ambulatory surgery may be different in the types and complexity of procedures performed, and the severity of patient illness, there remain many similarities that warrant the study of this setting as well, to quantify risk of blood exposure.

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## Methods

### Study hospital

The study hospital was a community hospital located in Washington state, with an average of 1050 inpatient and

ambulatory operative procedures per month. The hospital was one of several in a large, multicentre study of inpatient operative procedures reported elsewhere<sup>9</sup>.

#### *Procedures included in the study*

Operative procedures included all consecutive cases performed in the ambulatory surgery suite from 24 August to 30 November 1992. Procedures excluded were endoscopic procedures, vaginal deliveries, and procedures done outside the ambulatory surgery suite.

#### *Definitions*

Definitions used for the study were the same as those of White and Lynch in their study of inpatient operative blood exposures to personnel<sup>9</sup>. *Cutaneous exposure* was defined as visible blood on the skin of a healthcare provider; *parenteral exposure* was defined as visible blood on nonintact skin or mucous membranes of a healthcare provider, or when a puncture or cut with a used sharp occurred. Parenteral exposure was divided into three types: puncture or cut, blood contact with mucous membranes, and blood on nonintact skin. *Blood contact* was defined as all exposures, both cutaneous and parenteral.

#### *Data collection*

The nurse educator in the operating room was the coordinator of data collection for the project. She instructed the circulating nurses on the data collection form and definitions of exposures; written training material and a videotape were provided by the authors. The circulating nurses were instructed to ask 'Did anyone have a blood exposure?' at the end of every case, and whenever someone on the surgical team behaved as if contact with blood may have occurred. Dedicated observers were not used. The hospital sent completed forms to one author (PL) weekly; these forms were reviewed for completeness, and questions about the data were resolved by telephone discussions with the nurse educator.

Data on the surgical procedures included time of day, surgical service, case status (scheduled or emergency), anatomic location, and length of surgery rounded to the nearest hour (0 for those less than 30 min). Information on blood contacts included job classification, activity at the time of contact, device causing the injury (in the case of punctures or cuts), anatomic location of exposure, and whether or not the patient was exposed to blood of the healthcare worker.

#### *Data analysis*

First, descriptions of the outpatient surgeries were done using cross tabulations and the calculation of proportions, in order to characterize the types of cases performed in this setting. Second, the blood contacts that occurred during the data collection period were described, also using cross tabulations and proportions. The blood contact rate for cases was the number of cases in

which at least one blood contact occurred divided by the total number of cases performed. This case-contact rate was then divided into the parenteral exposure rate and the cutaneous exposure rate.

Second, bivariate analyses examined whether there were differences between operative cases with and without blood contact. Cross tabulations were made to examine such differences, and univariate statistics used included the Fisher's exact test for examinations of the relationship between characteristics of the surgery and the occurrence of blood contact. A stepwise logistic regression was performed on variables found significant, to evaluate the independent contribution of each variable to the dependent variable, blood contact, while controlling for the influence of the other variables. For all analyses, significance was set at  $\alpha = 0.05$  (two-tailed).

## **Results**

### *Descriptive information*

There were 376 ambulatory surgical cases reported; the most common services were general surgery (32.4%) and orthopaedic surgery (26.3%). As might be expected, the majority were performed on weekdays and during the 7 am–3 pm shift (94.9%), and only five of the 355 cases reporting on these variables were emergencies (1.4%). The mean length of surgery for all cases was 0.9 h.

Blood contact occurred during 11 cases for a case-contact rate of 2.9%. Two of the 11 blood contacts were punctures, for a parenteral exposure rate of 0.5%; the remaining nine were cutaneous exposures on intact skin (2.4%). Table 1 shows the services in which blood contact occurred; general surgery was the most common service, but orthopaedic surgery had the highest proportion of cases with contacts (7/99, 7.1%), and both punctures occurred during orthopaedic cases. All 11 contacts occurred on weekdays and during the 7 am–3 pm shift, and 10 of the 11 were during scheduled cases (data on this variable were missing for the 11th case). There was no significant difference in the mean length of surgery for those cases during which blood contact occurred as compared to those during which contact did not occur, although rounding the length of surgery to the nearest hour may have masked the presence of a difference in length of surgery between the two groups.

Table 2 shows the job classification of those who had blood contacts. Surgeons had over half the contacts (6/11, 54.5%) and experienced both punctures. Table 3 shows the activity performed and the physical location of the blood contact. Of the cutaneous exposures, contact with intact skin occurred most commonly on legs and feet, via protective clothing strikethrough without a specific activity mentioned; spatter and sawing resulted in cutaneous exposure on the face and neck. Both percutaneous exposures occurred on the fingers during injecting or suturing. No patients were exposed to a healthcare worker's blood.

Univariate analyses indicated that orthopaedic surgery was a significant predictor of cutaneous exposure (Fisher's exact test,  $P = 0.009$ ). When a logistic regression

**Table 1.** Surgical service by whether or not blood contact occurred in 375\* ambulatory surgeries, 1992

<i>Surgical service</i>	<i>Blood contact</i>		<i>No blood contact</i>		<i>Total</i>	
	<i>n</i>	<i>(%)</i>	<i>n</i>	<i>(%)</i>	<i>n</i>	<i>(%)</i>
General	1	(9.1)	121	(33.2)	122	(32.5)
Orthopaedic	7	(63.6)	92	(25.3)	99	(26.4)
Gynaecology	1	(9.1)	35	(9.6)	36	(9.6)
Oral maxillofacial	1	(9.1)	23	(6.3)	24	(6.4)
Neurosurgery	0	(0.0)	6	(1.6)	6	(1.6)
Thoracic	0	(0.0)	1	(0.3)	1	(0.3)
Obstetrics	0	(0.0)	1	(0.3)	1	(0.3)
Burn	0	(0.0)	1	(0.3)	1	(0.3)
Other	1	(9.1)	84	(23.1)	85	(22.7)
Total	11	(100.0)	364	(100.0)	375	(100.0 <sup>†</sup> )

\*Data were missing for one case.

†Percentages do not add up to 100, due to rounding.

**Table 2.** Job classification by type of blood contact among 11 healthcare workers who had blood contact during 376 ambulatory surgeries, 1992

<i>Job classification</i>	<i>Parenteral exposures: punctures</i>		<i>Cutaneous exposures: intact skin number</i>		<i>Total contact</i>	
	<i>n</i>	<i>(%)</i>	<i>n</i>	<i>(%)</i>	<i>n</i>	<i>(%)</i>
Surgeon	2	(100.0)	4	(44.4)	6	(54.5)
Scrub assistant	0	(0.0)	3	(33.3)	3	(27.3)
Circulator	0	(0.0)	2	(22.2)	2	(18.2)
Total	2	(100.0)	9	(100.0)	11	(100.0)

**Table 3.** Activity at time by location of blood contact among 11 healthcare workers who had blood contact during 376 ambulatory surgeries, 1992

<i>Activity at time of contact</i>	<i>Fingers, hands</i>		<i>Face, neck</i>		<i>Legs, feet</i>		<i>Total</i>	
	<i>n</i>	<i>(%)</i>	<i>n</i>	<i>(%)</i>	<i>n</i>	<i>(%)</i>	<i>n</i>	<i>(%)</i>
Parenteral: punctures								
Suturing and injecting	2	(40.0%)	0	(0.0%)	0	(0.0%)	2	(18.2%)
Cutaneous intact skin								
Protective clothing strikethrough (no specific activity)	0	(0.0%)	0	(0.0%)	3	(75.0%)	3	(27.3%)
Manipulating IVs	1	(20.0%)	0	(0.0%)	0	(0.0%)	1	(9.1%)
Sawing	0	(0.0%)	1	(50.0%)	9	(0.0%)	1	(9.1%)
Incising	0	(0.0%)	0	(0.0%)	1	(25.0%)	1	(9.1%)
Surprise splatter of blood (no specific activity)	0	(0.0%)	1	(50.0%)	0	(0.0%)	1	(9.1%)
Unknown	2	(40.0%)	0	(0.0%)	0	(0.0%)	2	(18.2%)
Total	5	(100.0%)	2	(100.0%)	4	(100.0%)	11	(100.0%)

was done to examine the influence of orthopaedic service on blood contacts, while controlling for other descriptors of surgery, orthopaedic surgery remained a significant predictor of blood contact (odds ratio 5.9, 95% confidence interval 1.4–24).

## Discussion

In this series of 376 ambulatory surgeries in a community hospital, blood contact occurred in 2.9 per 100 cases, and punctures occurred in 5 per 1000 cases. The exposures in these cases were either contact with intact skin or punctures; there were no occurrences of blood contact with nonintact skin or mucous membranes. The orthopaedic

service was associated with the highest number of contacts with blood, as well as the two punctures that occurred. Of interest is that contact via protective clothing strikethrough occurred most commonly to legs and feet, rather than to chest and arms; this may indicate an area needing greater protection from run-off.

These rates are lower than those found in studies of inpatient surgery. Predictors of blood exposures in those studies included characteristics that may distinguish inpatient from ambulatory surgery.

1. *Thoracic procedures*<sup>4</sup> have been identified as high-risk, but only one of 376 outpatient surgeries in this study was from that service and none were vascular procedures. Thoracic surgery performed in the ambula-

tory surgery setting is less serious and less bloody than inpatient thoracic cases. By contrast, orthopaedic surgery was found to be a predictor in this study. Many orthopaedic surgeries may be safely performed in an ambulatory setting, and these procedures may be the most bloody cases, and important to examine for preventive strategies.

2. *Length of surgery*, also a predictor of exposure in the inpatient setting, averaged less than one hour and was not important in predicting blood contact. Again, the nature of outpatient surgery may select for shorter cases. Alternatively, length may be a predictor in this setting as well, but a larger cohort of cases and a more precise measure of length of surgery may be needed to detect a relationship between length and exposure.

3. *Job class* has also been associated with exposure. Tokars and his colleagues found that 89% of injuries were sustained by resident or attending surgeons<sup>8</sup>. In this study, the 11 blood contacts were split more evenly between surgeons (54.5%) and nursing personnel (45.5%); both punctures, however, were experienced by surgeons.

Limitations to this study include the small number of cases studied; a larger study is planned, which will give enough power to detect predictors of this relatively rare event. This study provides evidence, however, that contact with blood, both cutaneous exposures on unprotected skin or via soaked protective clothing and percutaneous exposures do occur in ambulatory surgery. Although no exposures to mucous membranes or nonintact skin occurred, the contacts with intact skin and the activities during the contacts indicate that these exposures could occur as well. Preventive strategies should

not only be directed against injuries, but also should include prevention of contact with unprotected skin and protective clothing strikethrough.

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#### References

- 1 McCormick RD, Meisch MG, Ircink FG, Maki DG. Epidemiology of hospital sharps injuries: A prospective study in the pre-AIDS and AIDS eras. *Am J Med* 1991; 91 (suppl 3B): 301S-7S
- 2 Jagger J, Hunt EH, Brand-Elnaggar J, Pearson, R. Rates of needlestick injury caused by various devices in a university hospital. *New Engl J Med* 1988; **319**: 284-8
- 3 Jagger J, Hunt EH, Pearson R. Sharp object injuries in the hospital: causes and strategies for prevention. *Am J Infection Control* 1990; **18**: 227-31
- 4 Gerberding JL, Littell C, Tarkington A et al. Risk of exposure of surgical personnel to patients' blood during surgery at San Francisco General Hospital. *New Engl J Med* 1990; **322**: 1788-93
- 5 Popejoy SL, Fry DE. Blood contact and exposure in the operating room. *Surg Gyn Obstet* 1991; **172**: 480-3
- 6 Panlilio AL, Foy DR, Edwards JR et al. Blood contacts during surgical procedures. *JAMA* 1991; **265**: 1533-7
- 7 Quebbeman EJ, Telford GL, Hubbard S et al. Risk of blood contamination and injury to operating room personnel. *Ann Surg* 1991; **214**: 614-20
- 8 Tokars JI, Bell DM, Culver DH et al. Percutaneous injuries during surgical procedures. *JAMA* 1992; **267**: 2899-904
- 9 White MC, Lynch, P. Blood contact and exposures among operating room personnel: a multicenter study. *Am J Infection Control* 1993; **21**: 243-8

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