

# Risk of blood splashes to the eye during surgery

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## Summary

**Background.** With the advent of a new infectious era involving the HIV and hepatitis B and C viruses, concern has arisen about transmission of these viruses through ocular blood splashes during surgery. The purpose of the study was to determine the risk of ocular blood splashes to surgeons and their assistants during surgery.

**Method.** Surgeons and assistants in several surgical disciplines were requested to wear facemasks with a transparent plastic visor. The visors were collected postoperatively and inspected for macroscopic and microscopic blood splashes.

**Results.** Fifty-nine per cent of the surgeons and assistants refused to wear facemasks with a visor. The incidence of blood splashes in those who participated was 45%. There was a trend for blood splashes to be more common during major surgery and during elective surgery. Surgeons and assistants were subject to similar risk.

**Conclusion.** This study confirms the significant risk of ocular blood splashes during surgery, while also suggesting that both surgeons and assistants lack appreciation of the risk.

The prevalence of blood-borne diseases such as hepatitis B, hepatitis C and HIV is increasing globally. Sub-Saharan Africa is one of the worst-affected regions. The risk of infection from these blood-borne pathogens has become a significant occupational hazard for many categories of health care workers, including those involved in general surgery, obstetrics and gynaecology, orthopaedic surgery and dental surgery. Blood-borne infections can be transmitted via percutaneous injury or mucocutaneous exposure.<sup>1-4</sup> Although percutaneous injury carries the greatest risk of transmitting infection, transmission as a result of contact with mucous membranes has been described.<sup>5,6</sup> Several strategies have been introduced in recent years to minimise the risk of percutaneous transmission via needle-stick injuries. In contrast, the risk of mucocutaneous exposure via blood splashes to the eyes is either underestimated or not fully appreciated by health care workers.<sup>7-12</sup>

The present study was undertaken to determine the incidence of blood splashes to the eyes during surgery, and to investigate factors that may influence the degree of risk.

## Methods

The study was approved by the Ethics Committee of the Faculty of Health Sciences, University of Cape Town.

A prospective cohort study involving surgeons and assistants working in theatre at Groote Schuur Hospital, Cape Town, was undertaken. Surgeons were randomly selected for inclusion in the study, and included surgeons from General Surgery, Orthopaedics, ENT, Urology, Trauma, Gynaecology, Cardiothoracic Surgery and Plastic Surgery.

Surgeons and their assistants were invited prior to the operation to participate in the study. Those agreeing to participate were asked to wear a face mask with a transparent plastic visor. At the end of the operation, the visors were collected and inspected for macroscopic and microscopic blood splashes, as described below.

The number of macroscopic splashes was determined by inspecting the surface of the visor against a white background under a bright light. Each splash was counted and a black marker used to exclude those that had been counted. The splashes were graded as small, medium, large and very large. To facilitate counting of the splashes, the white background was divided into 1 cm squares.

Microscopic splashes were then counted with the visor on the white background using a Nikon SMZ-10 dissecting microscope, which is used for microsurgery, at 20× magnification.

The type and duration of the operation was recorded, as well as whether it was emergency or elective surgery, whether it was a major or minor operation, and whether any special equipment such as drills or magnification loupes were used. Minor surgery was defined as surgery involving superficial tissues, while major surgery involved opening either the abdomen or the chest.

## Statistical methods

Fisher's exact test was used to determine the significance of

the differences in the risk of blood splashes in terms of major versus minor surgery, emergency versus elective surgery, surgeons versus assistants, and whether special equipment was used or not. The Spearman correlation test was used to determine the relationship between the length of the operation and the number of blood splashes.

## Results

Seventy-four surgeons and assistants were invited to participate in the study. Of these, 44 (59%) did not wear the visor for the following reasons: 12 (28%) of the 44 complained that the visor was uncomfortable and fogged up during surgery; 3 (7%) operations were performed using an operating microscope and the surgeons could not wear the visors; 10 (23%) surgeons wore prescription glasses and thought that these were sufficient protection during surgery and complained that wearing a visor over these would be uncomfortable; 5 (11%) surgeons wore magnification loupes and thought that wearing the visor would be uncomfortable; and 14 (32%) surgeons forgot to wear the visor during surgery.

Thirty surgeons/assistants participated in the study, and a total of 49 visors were collected. Twenty-two (45%) of the 49 visors had blood splashes of which 15 (68%) were macroscopic; of the macroscopic blood splashes, 72% were small, 23% were medium and 6% were large. Sixteen (73%) of the 22 blood-splashed visors had microscopic blood splashes, of which 93% were small, 5% were medium and 2% were large. Seven (32%) visors had only microscopic splashes, and 6 (27%) visors had only macroscopic splashes.

Of the 36 visors worn during major operations, 18 (50%) had blood splashes compared with 4 (31%) of 13 visors worn during minor operations ( $p=0.33$ ) (Fig. 1). Fourteen (48%) of the 29 visors worn by surgeons had blood splashes, compared with 8 (40%) of the 20 worn by assistants ( $p=0.77$ ) (Fig. 2). Only 1 (13%) of the 8 visors worn during emergency surgery had blood splashes, compared with 21 (51%) of the 41 visors worn during elective surgery (Fig. 3). This difference approached statistical significance ( $p=0.059$ ).

Both of the visors worn by the surgeons/assistants who utilised magnification loupes had blood splashes, compared with 20 (43%) of the 47 visors worn by surgeons/assistants not using loupes.

There was no correlation between the length of the operation and the number of blood splashes ( $r=0.28$ )

## Discussion

HIV and AIDS have affected millions of people worldwide, sub-Saharan Africa being the worst-affected region. The prevalence of infections from other blood-borne pathogens, such as hepatitis B, is also high in developing countries. Exposure to blood and other potentially infectious body fluids has therefore become a major occupational hazard for health care workers, especially those involved in general surgery, obstetrics and gynaecology, orthopaedic surgery and dental surgery. Such infections could be acquired following either percutaneous exposure, such as a needle-stick injury, or mucocutaneous exposure, such as blood splashes to the eye.<sup>1-4</sup> The risks related to percutaneous exposure to blood and other potentially infectious body fluids are well documented, and many strategies have been introduced in recent years to limit the problem. However, the risk of mucocutaneous exposure, especially regarding blood splashes

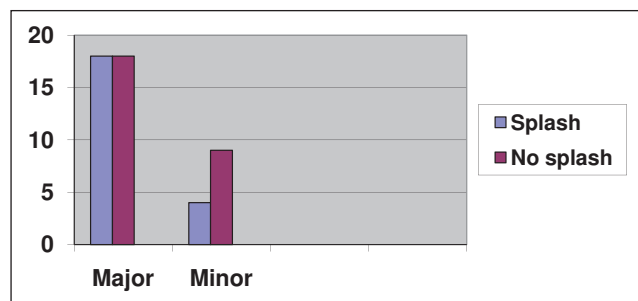


Fig. 1. Incidence of blood splashes during major and minor surgery.

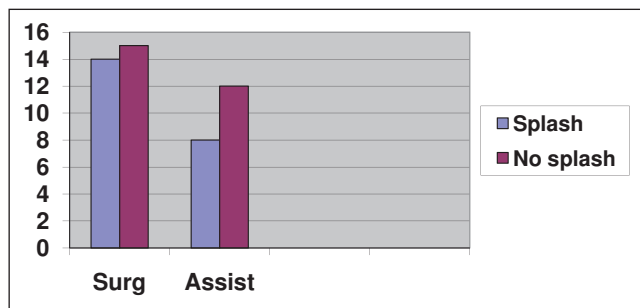


Fig. 2. Incidence of blood splashes on visors worn by surgeons versus assistants.

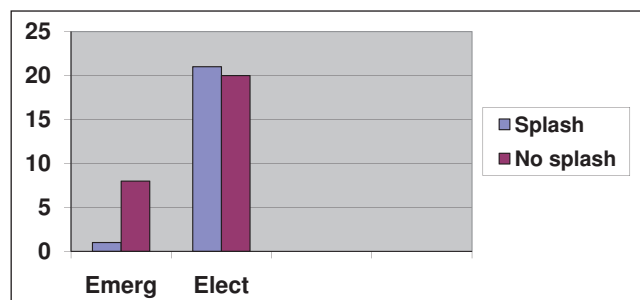


Fig. 3. Incidence of blood splashes during emergency versus elective surgery.

to the eyes, is under-estimated and not fully appreciated by health care workers in general.<sup>7-12</sup>

In this study, we found that 45% of the visors worn by surgeons/assistants had blood splashes. Over two-thirds of the contaminated visors had macroscopic blood splashes, which represents a significant risk of infection transmission from infected patients to surgeons during surgery.

One of the major limitations of this study is the small number of cases, making sub-group analysis very difficult. Blood splashes tended to occur more commonly during major operations compared with minor surgery, although the difference was not statistically significant. Both surgeons and assistants were at similar risk of exposure to blood splashes.

In view of the very high prevalence of HIV infection and the fact that the HIV status of patients is usually unknown, it is recommended that surgeons routinely adopt universal precautions. The latter would include wearing protective eyewear in the form of goggles or masks with visors. However, several surgeons in this study refused to wear the visors on account of discomfort and fogging; this is of some concern and demonstrates a lack of appreciation of the risk of blood splashes to the eye. Fogging of the visor is a problem that can be easily overcome by tying the lower tape of the mask loosely.

Some surgeons refused to wear the visor because they regarded their prescription spectacles as sufficient protection. However, a study looking at blood splashes on spectacles reported a number of splashes on the inside of spectacles,<sup>12</sup> which indicates that spectacles cannot be relied upon to provide adequate protection from blood splashes. In this study, the incidence of blood splashes was 45%.

Other studies have found a similar incidence of ocular blood splashes in general surgeons.<sup>7,8</sup> However, a much higher incidence (62%) of ocular blood splashes was reported in a study of surgeons performing caesarean sections.<sup>1</sup> Studies that reported on macroscopic blood splashes only found a much lower incidence of blood splashes.

In this study, the incidence of blood splashes on visors was greater during elective surgery; this is a surprising finding. However, it may be related to the small number of emergency operations. This study did not show any correlation between duration of procedure and incidence of blood splashes. Again this is surprising, especially since other studies have shown such a correlation.<sup>8</sup>

Our results demonstrate a 48% incidence of blood splashes to the eye, and a most concerning lack of appreciation of the risk by the attending medical personnel. In view of the extremely high HIV prevalence in our patient population, health authorities should consider enforcing mandatory use of eye protection for staff performing surgical procedures.

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