East African Medical Journal Vol. 85 No. 9 September 2008
RISK OF CONJUNCTIVAL CONTAMINATION FROM BLOOD SPLASHES DURING SURGERY AT THE KENYATTA NATIONAL HOSPITAL, NAIROBI
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S.W.O. OGENDO, M. N. AWORI, M. A. OMONDI, E. M. MULATYA and P.W. MUGO

ABSTRACT

Objectives: **To determine the utilisation rate of design specific eye protection by surgeons and to assess the risk of conjunctival contamination with blood splashes during surgery.**
Design: **Cross sectional, observational study.**
Setting: **The theatre suite of Kenyatta National Hospital, Nairobi**
Subjects: **Surgeons from all specialties operating in the theatre suite.**
Results: **The minority of surgeons, 5.2% utilised protective eye goggles compared to 3.5% of assistants. Prescription eye spectacles were the most common form of eye protection at 41.9 and 20.9% respectively for surgeons and their assistants.**
The contamination rate for provided protective eye wear was 53.1% with the average number of droplets being 2.48 per procedure for the principal surgeon.
The duration of surgery and the use of power tools influenced the contamination rate.
Conclusions: **The utilisation rate of design specific protective eye wear is low and with a significant risk of conjunctival contamination, changes in attitudes and practices are needed to increase utilisation.**

INTRODUCTION

Surgeons today are exposed to blood borne mucous membrane infections by pathogens as they perform their clinical activities in theatre and other work areas. Such infections include HIV, hepatitis B and C virus to name but a few.

Compliance with universal precautions has been shown to reduce the risk of exposure to blood and body fluids. Studies have shown that wearing prescription glasses reduces chances of conjunctival contamination but not as effectively as design specific eye goggles (1).

The aim of this study is two fold. First to determine the utilisation rate of custom made protective eye ware, and secondly to establish the risk of conjunctival contamination from blood splashes among surgeons.

MATERIALS AND METHODS

This study was a cross sectional observational study carried out over a three month period from 17th July to 16th October 2007 in the main surgical theatres of the Kenyatta National Hospital in Kenya. The first part of the study observed the usage rate of custom designed protective eye goggles amongst surgeons, while the second part determined the contamination rates of provided protective eye goggles by blood splashes during surgery.

All surgical specialists utilising the main theatres of the hospital, and who consented to participate in the study formed the study population. Only primary surgeons and their first assistants were included into the study.

Excluded from the study were those surgeons declining to take part in the study, endoscopic procedures or minor operations involving incisions less than 3 cm in length and all procedures outside normal working hours. Protective eye goggles with a side shield were provided to all participants. These were re-used by washing in-between surgeries.

At the end of each surgery all goggles provided were inspected and the number of macroscopic blood splashes determined. Contamination will be classified as small, medium or large if the numbers

of splashes are one to five specks, six to ten specks or greater than ten respectively. In situations where the blood is literally running down the goggles this will be classified as large irrespective of other splashes. For purposes of statistical analysis this type of splash was considered as 15 drops.

Other determinations will include comparison of blood splash contamination between the surgeon and the assistant, different specialties and the use of power tools. Data is analysed using SPSS version 11.5 and significance testing at less than a p-value of 0.05 is considered significant.

RESULTS

For the first part of the study a total of 346 surgeons and their assistants were observed in 173 procedures. A minority of surgeons, 5.2%, were observed to utilise design specific eye protection goggles during operative procedures compared to only 3.5% of assistants.

Prescription eye spectacles were however the most common form of "inadvertent" eye protection observed in 41.9 and 20.9% respectively of the surgeons and their assistants.

The various reasons provided by the operating personnel for not using protective goggles ranged from being uncomfortable, unavailable and misting to reasons like prescription glasses are adequate. (Figure 1)

In the second part of the study 81 procedures were selected, a breakdown of the participants as per specialty is illustrated in Table 1.

Figure 1
Reasons for not using protective goggles

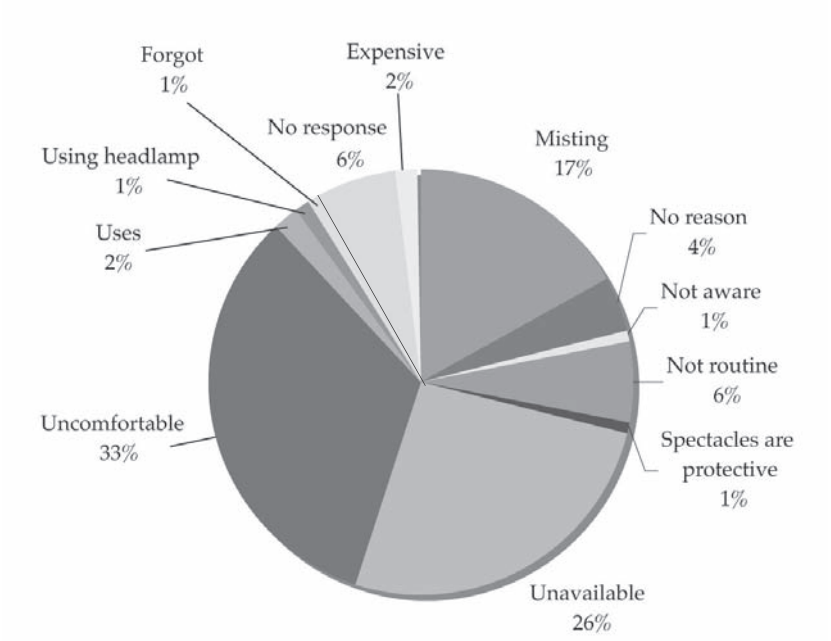


Table 1
Study participants per specialty

	Frequency	(%)
Cardiothoracic	7	8.6
Otolaryngology	3	3.7
General surgery	26	32.1
Maxillofacial surgery	3	3.7
Neurosurgery	4	4.9
Obstetrics/Gynaecology	7	8.6
Orthopaedics	21	25.9
Paediatric surgery	1	1.2
Plastic surgery	5	6.2
Urology	4	4.9
Total	81	100

The distribution of the blood splashes received on the provided goggles is illustrated in Table 2. No splash being the most common frequency while the greatest number of splashes on the provided goggles was 15. The mean number of blood splashes observed per procedure was 2.48 drops for the surgeons and 1.49 for the assistants ($p < 0.05$). Forty six point nine percent of the surgeons received no blood splashes on their goggles, 34.6% received a small number of splashes (1 – 5 splashes), while 13.6% and 4.9% respectively received a medium (6 – 10 drops) and large amount of splashes (> 10 drops), respectively.

The surgeons demonstrated a persistently greater count of droplet contamination compared to their assistants. (Figure 2)

The specialties of neurosurgery, ear nose and throat and maxillofacial surgery experienced the largest number of blood splashes with paediatric surgery and plastic surgery having no splashes during the study period, (1 and 5 surgeons only) (Figure 3). Duration of surgery had a significant effect, ($p < 0.01$), on the number of blood splashes experienced by the operating teams, (Table 3).

Table 2

Observed blood splashes on protective eye ware, surgeon and assistant

Number of drops	Frequency (surgeon)	Percentage (surgeon)	Frequency (assistant)	Percentage (assistant)
0	38	46.9	51	63.0
I	6	7.4	6	7.4
2	12	14.8	6	7.4
3	5	6.2	7	8.6
4	4	4.9	4	4.9
5	1	1.2	1	1.2
6	4	4.9	1	1.2
7	3	3.7	1	1.2
8	1	1.2	-	-
9	2	2.5	2	2.5
10	1	1.2	-	-
11	-	-	-	-
12	2	2.5	-	-
15	2	2.5	2	2.5

Figure 2

Comparison of droplet contamination of surgeon and assistant per specialty.

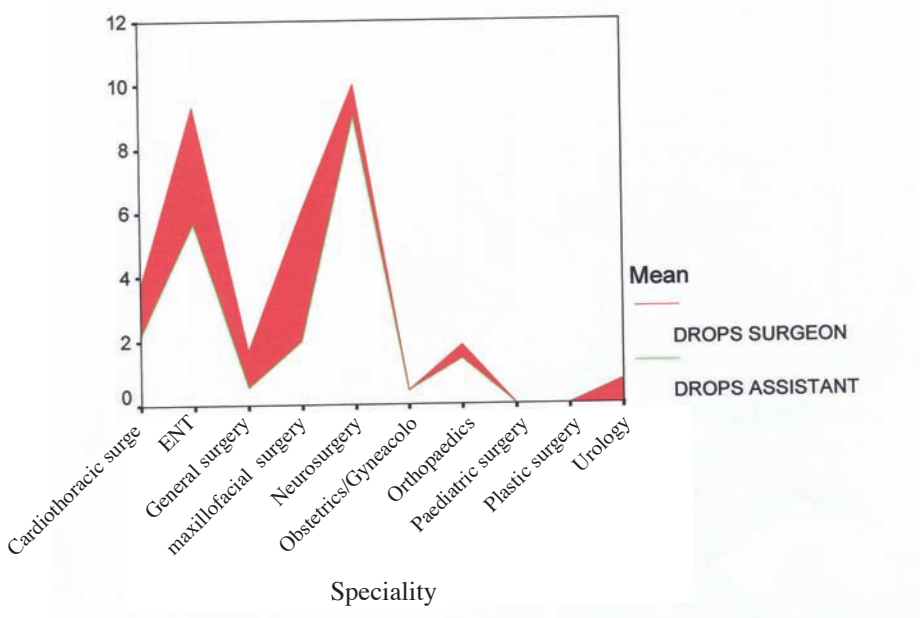


Figure 3
Box chat comparison of blood splashes per specialty

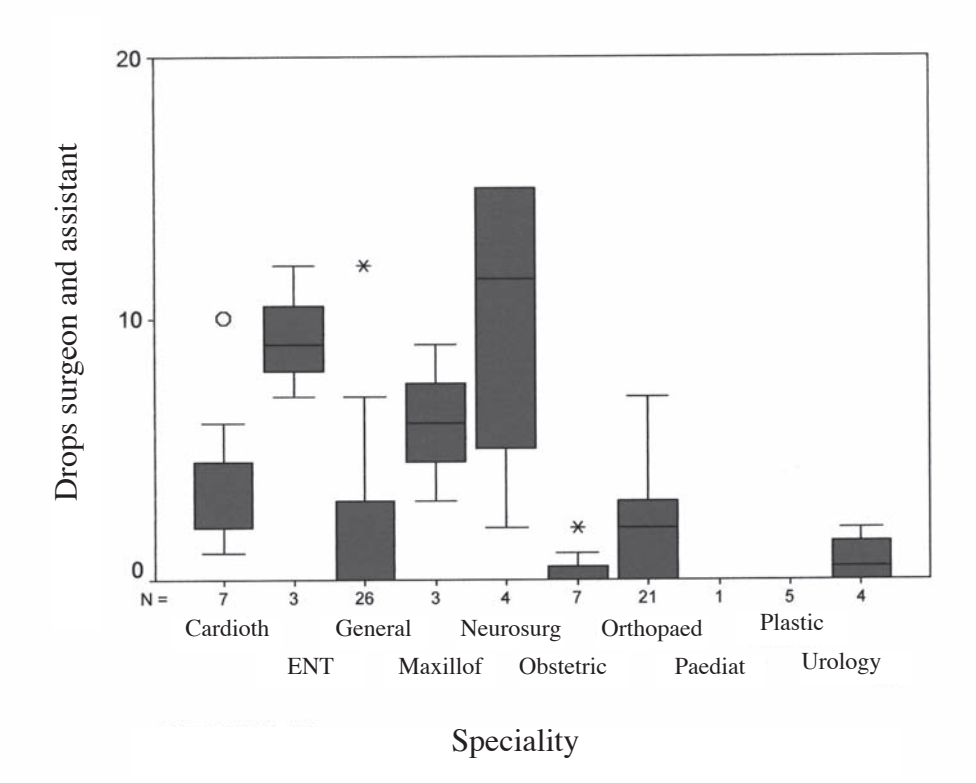
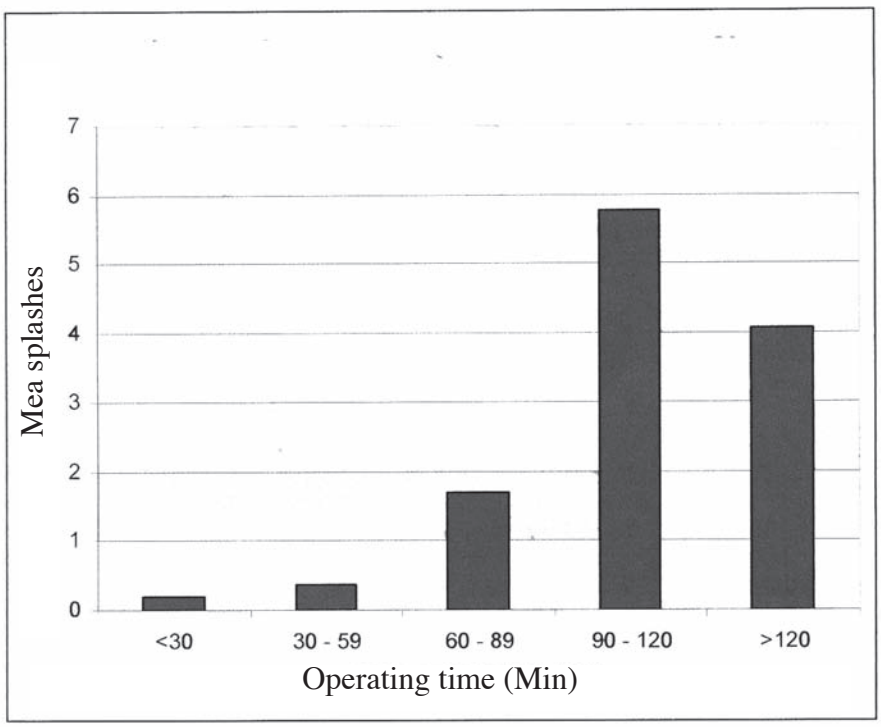


Table 3
Blood splashes versus duration of surgery



A significantly greater number of splashes were associated with the use of power tools during surgery. Per procedure 9.0 drops were observed where power tolls were used compared to 2.68 drops per procedure where power tools were not used, (p = 0.01).

DISCUSSION

Most surgeons are aware of the risk of occupational blood borne infections, but not all surgeons go by the universal precaution codes, and this reveals a gross underestimation of chances of contracting blood borne infection. Local health and safety practices in any health facility as well as the low importance attached to health and safety in the undergraduate medical curriculum influence safety practices (2, 3).

Universal precautions and more recently standard precautions have been widely promoted in high-income countries to protect health care workers from occupational exposure to blood and the consequent risk of infection with blood borne pathogens. In low-income countries, the situation is slightly different, universal precautions are often practiced partially, if at all, thereby exposing the health care workers to risk of infection (4). The same would probably be expected for Kenya, and this is borne out in this study with a less than 6% utilisation rate of design specific protective eye wear. The more senior surgeons showing a greater utilisation rate than their junior colleagues. Other centres within the regional report slightly higher utilisation rates amongst doctors ranging from 53 to 30.3%, (5-7).

An Indian study evaluating knowledge and understanding of universal precautions revealed that the understanding of universal precautions was partial, and universal precautions compliance was suboptimal. Only 32% of respondents wore eye protection when indicated, and 40% recapped needles at least sometimes (4).

In this Kenyan hospital the three most common reasons for not using eye protection were, they were uncomfortable 33%, not available 26% and misting at 17%. Improvements must be made to enhance understanding of the need for health workers to protect themselves despite minimal discomfort, additionally employers should provide the necessary equipment needed to achieve this. Misting on the other hand truly is an issue with eye goggles, however with slight adjustment of face masks and goggles this problem can be eliminated.

Outside the region, in the United Kingdom, 48% of orthopaedic surgeons interviewed in one study did not utilise practice eye protection during orthopaedic procedures, 28% even claiming eye protection was not necessary (8). In a Dutch study, up to 83% of respondents failed to use provided protection clothing (9).

For the current study the contamination rate was 53.1%, with an average of 2.8 goggle splashes per procedure, the majority, 34.6%, being minor splashes. This compares with a 41% splash rate from a teaching hospital in a Nigerian study (10). Most surgeons were unaware of the splashes having taken place and only realised during the final goggle examination at the end of surgery. The primary surgeon experienced twice the contamination compared to his assistant in the ratio of 2:1. This compares to proportions ranging from 1.6 to 4.7 times more for the primary surgeon in other studies (11). Differences in the contamination rates are also observed between the different specialties. The disciplines of neurosurgery, ear nose and throat and maxillofacial surgeries received the highest rates of contamination for the present study.

Increased contamination has been reported to be associated with the use of power tools and irrigation (12, 13) and this generally has as a general rule been associated with orthopaedics. Orthopaedics in this study however had a relatively lower contamination rate and why this is so is not immediately clear as power tools are the norm during their surgeries at this facility. For this study the duration of surgery also significantly affected contamination. Longer exposure to a risk will obviously increase the chances with time.

Considering specialties other than orthopaedics, observations during tonsillectomy report contamination rates of protective visors reached 48%, additionally no surgeon performing more than three operations escaped contamination (14). For vascular procedures 51% of principal surgeons' visors were contaminated, while the contamination rate for the assistant was also high, 36%, (15). In plastic surgery a contamination rate of 29.3% is recorded, with surgeon awareness in only 4% of episodes (16), for the urologist performing transurethral resection of the prostates rates of contamination of 67% were observed (17). In essence all specialties are at risk of contamination and this is consistent with the findings in this study. For those specialties with no contamination observed this is most probably the result of the low number of cases enlisted into the analysis from that specialty urology being a case of note.

Eye contamination through blood splashes can be significantly reduced by wearing prescription glasses and are completely eliminated in surgeons wearing more specialised goggles or full face shields (18). Ordinary spectacles do provide a reasonable degree of protection reducing the risk of contamination by a factor of ten (1).

For the study the use of prescription spectacles was significant. Despite the protection provided to the eyes, this is not an acceptable form of eye protection. Health and safety issues as well as hygiene related

to contamination of personal clothing items with body fluids make this unacceptable. Additionally the current trend of slim spectacles further adds to the risk of conjunctival contamination around the edges of the spectacles.

These surgeons should be advised either to wear the goggles over their prescription glasses or instead of their prescription glasses.

CONCLUSIONS AND UNRESOLVED ISSUES

This study shows beyond doubt that the utilisation rate of protective eye ware is low and needs to be improved. In addition to a low utilisation the risk of contamination is significant. The authors have no reason to think the situation in other health facilities within the country is any different from the findings in this institution.

The knowledge relating to the importance of protective eye wear usage is present but changes in attitudes and practices need to be enforced to avoid loss of valuable manpower through blood born morbidity and possibly later mortality.

The study suffers a number of limitations;

(i) Microscopic splashes are not included in this study and eye contact through aerosolisation, (droplets ≤10μm in diameter), of blood is a potential risk.

(ii) What is not clear is the inoculation dose required to become infected with the HIV virus. Studies suggest the risk of infection through needle prick injuries is in the region of 0.5%, (19), however it is thought that eye contamination poses an even less risk (20). As the inoculation dose and the risk of actually acquiring HIV infection not known the interpretation of the study result may be difficult.

(iii) Not all splashes that appear on the protective goggles necessarily would have hit the conjunctiva depending on their tangentry. Therefore this study will be an overestimation of the risk for conjuctival contamination.

ACKNOWLEDGEMENTS

To the administration of the Kenyatta National Hospital for permission to carry out the study and for permission to publish.

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