

# Scalpel-free surgery could reduce surgeons' risk of HIV and hepatitis

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## ABSTRACT

The risk of intraoperative Human Immunodeficiency Virus (HIV) infection poses a challenge to practicing surgeons worldwide, particularly in sub-Saharan Africa with its high HIV prevalence. The risk of acquiring HIV infection from one infected percutaneous exposure is 0.3-0.4% . Prior to extensive screening, blood transfusions were responsible for an estimated 5-10% of new HIV infections in sub-Saharan Africa. In this paper we describe the experience of minimally invasive techniques as alternatives to surgery in urology patients. Trans-urethral ethanol ablation of the prostate (TEAP) for prostatic enlargement, phenol sclerotherapy for hydroceles, and percutaneous aspiration and sclerotherapy for symptomatic renal cysts may result in reduced blood loss, and diminished contact with the patients' exposed tissues or body fluids compared with more invasive surgical options.

## INTRODUCTION

Human Immunodeficiency Virus and Acquired Immunodeficiency Syndrome (HIV/AIDS) are among the most difficult challenges facing practicing surgeons worldwide. Surgeons are at risk of occupationally-acquired infection as a result of intimate contact with the blood and other body fluids of HIV positive patients requiring surgery<sup>1</sup>. The challenge is more acute in sub-Saharan Africa as it currently has the highest prevalence of HIV infection in the world. Zambia alone has an estimated 1.1 million people infected with HIV. Other bloodborne infections, such as hepatitis B and C also pose significant risks, although the prevalence of infection in Zambia is not well known. This article

will summarize the infectious transmission risks inherent to surgical procedures and the potential strategies for reducing those risks. We will further describe three minimally invasive urologic procedures that can be considered as a part of this risk-reduction strategy.

## BACKGROUND

Surgeons routinely work with potentially infectious materials. The risk of acquiring a disease from one percutaneous exposure is 0.3-0.4% for human immunodeficiency virus (HIV), 6-30% for hepatitis B virus (HBV) and 2.7-10% for hepatitis C virus (HCV). Rates of blood contacts vary but may reach up to 11.9 per 100 h in the operating room<sup>2</sup>.

The risk of occupational blood-borne infections for health care workers (HCWs) has been reassessed in the last decades in relation to the spread of pathogens associated with significant morbidity and mortality, in particular HBV, HCV and HIV.<sup>1</sup> At-risk incidents have been identified as needle stick injuries or cuts with contaminated instruments, as well as blood contamination of open wound or of mucous membranes and possibly of a wide skin area with prolonged contact<sup>3,4</sup>.

Blood transfusions are another significant mode of HIV transmission in the health care setting. Prior to the extensive screening of blood products, transfusions were responsible for an estimated 5-10% of new HIV infections in sub-Saharan Africa<sup>21</sup>. More recently, The transfusion-associated risks of becoming infected with HIV, HBV, and HCV in sub-

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Saharan Africa were 1, 4.3, and 2.5 infections per 1000 units, respectively. If annual transfusion requirements projected by the WHO were met, transfusions alone would be responsible for 28,595 HBV infections, 16,625 HCV infections, and 6650 HIV infections every year. Sensitivity analysis suggests that the true risks may be even higher<sup>5</sup>.

The risk of contracting HIV infection for a surgeon practicing in Zambia for 5 years is 1.5%<sup>6</sup>. The risk for a surgeon working in a Western hospital is estimated at 0.1%<sup>7</sup>. Although occupational exposure rate was relatively low, the HIV seroprevalence was so high that the relative accumulated seroconversion risk for surgeons in tropical Africa has been estimated to be 15 times higher than in Western countries. This implies that each year one out of every 300 African surgeons may become occupationally infected with HIV, and the risk is likely similar among other healthcare workers frequently exposed to sharps<sup>6</sup>.

The risk of becoming infected with blood-borne pathogens during surgery is real. The degree of risk for peri-operative personnel is related to factors that include participating in large numbers of surgical procedures each year; the nature of peri-operative work (e.g., use of different types of sharp instruments); exposure to large amounts of blood and body fluids; the prevalence of blood-borne pathogens in the surgical population. Controlling risks to peri-operative personnel can be accomplished by using the Occupational Safety and Health Administration's three methods of control: redesigning surgical equipment and procedures, changing work practices, and enhancing the personal protection equipment of peri-operative personnel<sup>8</sup>.

## **PATHOGEN EXPOSURE RISK DURING PROCEDURE**

Researchers reviewing operating room (OR) studies in detail have found a percutaneous injury rate of between 1.7% and 15% during periods ranging from 1 to 10 months, depending on the type of operation and other factors. The occupational groups participating in surgery who sustain the greatest number of percutaneous and other injuries are surgical residents and surgeons. In one study, however, scrub people sustained as many percutaneous injuries as surgeons<sup>9</sup>.

## **STRATEGIES TO REDUCE RISK DURING SURGERY**

It has been argued that using standard precautions is an insufficient strategy to reduce exposure to blood-borne pathogens in the OR and that an industrial hygiene model would be more useful. This approach, in fact, is the basis for the Occupational Safety and Health Administration's (OSHA) blood borne pathogen standard<sup>10</sup>.

This model emphasizes a hierarchy of controls that should be applied in ORs in three levels:

**Level one** - The first level of control involves modifying the tools with which work is performed rather than attempting to change human behaviour. In an OR, this could mean performing bloodless surgery (e.g., using ultrasound to reduce kidney stones rather than a laparotomy), as well as redesigning devices and equipment (e.g., use of blunt suture needles whenever possible). It also is possible to blunt other devices, such as scissors, retractors, and clamps. Although not available in our setting, the use of robots also can be considered a first level of control when robotic hands replace the surgeon's hands. When the data analysis controlled for potentially confounding factors (e.g., length of surgery, blood loss, type of procedure, surgical technique), researchers found that use of blunt needles was progressively more protective as more blunt needles replaced sharp ones. It also is possible to blunt other devices, such as scissors, retractors, and clamps<sup>11</sup>.

**Level two** - The second level in OSHA's hierarchy is work practice controls (i.e., changing the way in which the work is performed). Some of the safety recommendations made by individuals and professional associations at this level include substituting staples for sutures, announcing that a sharp will be passed, never tying sutures with the needle in your hand, and using the electrosurgical unit for cutting tissue<sup>12</sup>.

**Level three** - The third level of control promotes the use of personal protective equipment and other forms of personal protection. In the OR, gloves, gowns, masks, and protective eye wear, as well as the hepatitis B vaccine and post-exposure prophylaxis to HBV or HIV, are examples of this mitigating, third level of control<sup>13</sup>.

In level one, measures involving the use of minimal invasive surgery aim to reduce the risk of exposure to infectious materials during surgery for the health workers and for the patients. Here we present three previously published case series that demonstrate our experience with minimally invasive urologic techniques that result in reduced blood loss and diminished contact with the patients' exposed tissues or body fluids. These effective techniques may be used in lieu of open surgery in appropriately selected patients.

### 1. TRANSURETHRAL ETHANOL ABLATION OF THE PROSTATE (TEAP) AS A TREATMENT OPTION FOR PROSTATIC OBSTRUCTION

Prostate disease accounts for 33% of urology conditions in Zambia. The most common of these is benign enlargement of the prostate (BEP). The standard care of patients with BEP in Zambia is either open prostatectomy or trans-urethral resection of the prostate (TURP). In open prostatectomy, blood transfusion is required in 12.7% of the patients either intra-operatively or postoperatively<sup>14</sup>. In TURP, excessive bleeding is seen in around 3% of patients, and a patient may need a blood transfusion or a second operation to stop the bleeding<sup>15</sup>. Another complication, TURP syndrome, can occur when a patient develops symptomatic hyponatremia secondary to the absorption of irrigating fluid through prostatic veins or breaches in the prostatic capsule during the procedure.

We performed a prospective study at the University Teaching Hospital (UTH) in Lusaka, where we evaluated the effectiveness of transurethral ethanol ablation for the prostate (TEAP) as a treatment modality for obstructive BEP. This procedure involves the intra-prostatic injection of dehydrated alcohol and can be performed as a day case under regional anesthesia using cystoscopy. The procedure is relatively simple and can be completed in about 15 minutes.

A total of 45 patients with documented bladder outlet obstruction secondary to BEP were enrolled in the study. The patients were followed up for 30 months post-operatively. The main results of the study are summarized in Figure 1. We found that intraprostatic ethanol injections produced remarkable sustained symptomatic relief without

any significant complications. No patients required blood transfusion. One patient needed further intervention, and he underwent TURP 6 months later. The chief limitation of that study was the absence of a control group for comparison.

The benefits of the TEAP technique are mainly avoiding blood eye splash to the health workers in theatre, especially the surgeons, and avoiding blood transfusion to the patients<sup>16</sup>.

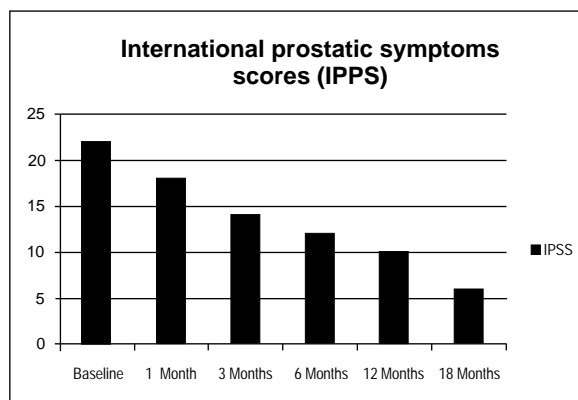


Figure 1: AUA symptom score before and after TEAP

### 2. SCLEROTHERAPY WITH PHENOL INSTEAD OF OPERATIVE TREATMENT FOR HYDROCELE

The standard care of hydrocele in Zambia is hydrocelectomy. Risks related to hydrocele surgery may include: blood clots, infection, and injury to the scrotal tissue or structures<sup>17</sup>.

A comparative study of sclerotherapy with phenol versus surgical treatment for hydrocele was conducted at UTH. A total of 80 patients with hydrocele were randomly divided into 2 groups of 40 each. Group A underwent phenol sclerotherapy in the outpatient urology clinic and Group B underwent hydrocelectomy in theatre under anesthesia. In the sclerotherapy group 47.5%, 32.5%, and 15% of the hydroceles were cured with 1 to 3 injections, respectively (Figure 2), but 4% were not cured. There were no complaints of localized pain or infection in these cases. All patients returned to normal activities on the same day. In the hydrocelectomy group, all the patients were cured. There was pain postoperatively in 73.5% of the patients and localized infection in 9%, while 65%

required an average of 4 days of rest and were absent from work for 10 days. As with many surgical studies, one limitation of this study was that we were not able to blind patients and treating doctors to the group assignment. We concluded that sclerotherapy using phenol as treatment for hydrocele is as efficient as hydrocelectomy for cure, has lower risk of complications and allows the patients to return to normal activity on the same day. Importantly, this technique resulted in diminished contact with the patients' exposed tissues or body fluids compared with hydrocelectomy. Sclerotherapy is recommended as an option for treatment of hydrocele<sup>18</sup>.

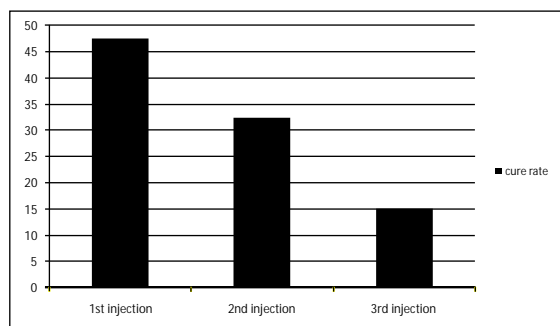


Figure 2. Cure Rate and Number Of Applications

### 3. PERCUTANEOUS ASPIRATION AND ETHANOL SCLEROTHERAPY FOR TREATMENT OF SYMPTOMATIC SIMPLE RENAL CYSTS

The standard care of symptomatic simple renal cyst in Zambia is open decortications of the cyst. Open surgical cyst decortication for pain relief through an abdominal incision is associated with considerable morbidity and protracted convalescence and must be done under general anaesthesia<sup>19</sup>.

We enrolled 17 patients (11 men and 6 women, mean age of 46 years) with symptomatic simple renal cysts seen at the UTH urology clinic. The patients were treated by ultrasonography (US)-guided percutaneous aspiration and with an injection of 95% ethanol. Patients were evaluated 1 month postoperatively and every 6 months thereafter by clinical assessment, US, and intravenous urography. Success was defined as complete when there was total ablation of the cyst and partial when there was a recurrence of less than half the original cyst volume

and a resolution of symptoms. Failure was defined as the recurrence of more than half of cyst volume or persistent symptoms.

During a mean follow-up of 19 months (range 14–40), there was complete cyst ablation in 15 (88%) patients and partial resolution in 2 (12%). No treatment failures occurred. The study was limited by the lack of a control group.

Ethanol sclerotherapy for symptomatic simple renal cysts is simple, minimally invasive, and highly effective. We recommend it as the first therapeutic option in these patients. This technique resulted in reduced blood loss, and diminished contact with the patients' exposed tissues or body fluids<sup>20</sup>.

### CONCLUSION

A tremendous amount of work is necessary to redesign surgical sharps and procedures so that exposure to blood and body fluid is reduced significantly during operation. Such work is necessary to improve the safety for healthcare workers, and OSHA's three levels of control provide good methodology to reduce the risk of blood borne pathogen transmission during operations.

But arguably, the best way to reduce blood-borne infection risk is to preferentially select effective procedures that limit surgeons' exposure to body fluids and limit patients' blood loss and transfusion requirements. We feel that the three procedures described here accomplish these goals and should be considered as good therapeutic options, particularly in regions with high HIV and hepatitis prevalence.

Characteristics	No. of patients
Sex	
Male	11 (65%)
Female	6 (35%)
Laterality	
Right	9 (53%)
Left	8 (47%)
Success	
Complete	15 (88%)
Partial	2 (12%)

Table 1: The demographic characteristics, clinical presentation, and success rate of patients with simple renal cysts

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