

## An audit of surgical site infection following open prostatectomy in a Nigerian Teaching Hospital

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### Abstract

**Background:** Surgical site infections (SSI) are a potential cause of morbidity and increased cost of care after operations such as open prostatectomy.

**Objective:** To audit the occurrence of SSI after open prostatectomy at the Obafemi Awolowo University Teaching Hospitals Complex (OAUTHC), Ile-Ife, Nigeria

**Methods:** A review of all patients who underwent open prostatectomy over a ten-year period (July 2005 to June 2015). Data analysis was done using the statistical package for social sciences version 21. Association between variables was determined using Chi-square or Fisher's exact test as appropriate. A p-value < 0.05 was considered statistically significant.

**Results:** A total of 247 open prostatectomy surgeries were reviewed, with the patients' ages ranging from 43 – 91 years and a mean age of  $67.0 \pm 8.8$  years. Elective procedures were 98.8% while the remaining 1.2% were emergency cases. There were 24 (9.8%) surgical site infections. The duration of admission of the patients with SSI ranged from 6 – 15 days with a mean of  $9.5 \pm 3.2$  days, as against 4 – 9 days (mean of  $5.0 \pm 2.1$  days) for those without SSI. All the patients with SSI were successfully managed with no resultant mortality. Risk factors identified for SSI were emergency surgery ( $p=0.001$ ), obesity ( $p<0.0001$ ), diabetes mellitus ( $p=0.008$ ), smoking ( $p<0.0001$ ), pre-operative catheterization ( $p<0.0001$ ), excessive haemorrhage ( $p<0.0001$ ) and post-operative suprapubic bladder drainage ( $p<0.0001$ ).

**Conclusion:** SSI is a recognized complication of open prostatectomy. Identified risk factors for its occurrence from this audit are emergency operation, obesity, diabetes mellitus, smoking, pre-operative catheterization, excessive haemorrhage and post-operative suprapubic bladder drainage. Age, approach to prostatectomy (retropubic vs transvesical), incision type (lower midline vs pfannenstiel), level of the surgeon, catheter type and modality of irrigation were however not significant risk factors for post-prostatectomy SSI in this study.

**Keywords:** Surgical site infection, risk factors, open prostatectomy.

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### Introduction

Surgical site infections (SSI) can occur within 30-days after surgery (up to one year after implant surgery) and affect either the incision bed or deep tissues at the operation site<sup>1</sup>. They are adverse surgical sequel which could lead to significant morbidity, patient discomfort and increased cost of surgical care, since they impose severe demands

on the already meager health care resources<sup>2,3</sup>. Although transurethral resection of the prostate has become the gold-standard, open simple prostatectomy is however still carried out for treatment of patients with benign prostatic hyperplasia (BPH) in our environment because of the relatively large prostate size encountered possibly due to genetic predisposition and/or late patient presentation<sup>4,5</sup>. In addition, open prostatectomy has the lowest failure rate among the different surgical options for BPH and can be used to simultaneously tackle complications such as bladder diverticulum during same surgery<sup>6</sup>. However, as with any other surgical procedure, it can be followed by infective complications and this review is an outcome audit of SSI in patients who had open simple prostatectomy at our university teaching hospital in SouthWestern Nigeria over

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a 10-year period. The aim was to determine the incidence of post-prostatectomy SSI and identify possible risk factors for its occurrence.

## Methods

The study was conducted at the Obafemi Awolowo University Teaching Hospitals Complex (OAUTHC), Ile-Ife; a 733-bedded tertiary hospital located in SouthWestern Nigeria. The record of all patients who had open simple prostatectomy in the hospital between July 2005 and June 2015 were reviewed after obtaining ethical approval. Key criteria for inclusion were either transvesical or retropubic prostatectomy within the specified period. The patients were evaluated in our out-patient clinic 2-6 weeks before surgery. Their urine dipstick was repeated on admission and those suggestive of urinary tract infection (UTI) in this immediate pre-operative period were excluded. All the patients recruited had antibiotic prophylaxis at induction of anaesthesia based on local microbiological guidelines. Those that developed post-prostatectomy SSI were identified based on a combination of clinical and

microbiological evaluation and their demographic characteristics, clinical presentation, SSI risk factors, duration of admission and treatment outcome were extracted and analyzed using the statistical package for social sciences (SPSS) version 21. Cross tabulation was done and association between variables was determined using Chi-square or Fisher's exact test as appropriate. A p-value < 0.05 was considered statistically significant.

## Results

A total of 247 open simple prostatectomy operations were performed during the period under review, with age range of the patients being 43 - 91 years (mean age 67.0 ± 8.8 years). The operations were elective procedures in 244 patients (98.8%) and emergency in 3 patients (1.2%). There were 24 (9.8%) cases of SSI and their identified risk factors are elucidated in Table 1. The duration of admission in the patients with SSI ranged from 6-15days (mean of 9.5 ± 3.2 days), as against 4-9 days (mean of 5 ± 2.1 days) in those without SSI. All the patients with SSI were successfully treated using conservative measures.

**Table 1: Risk factors for surgical site infection**

Parameter		Total number (%)	Number with SSI (%)	Statistical analyses
Age	40-50 years	7 (2.8)	1 (4.2)	FET = 0.946; p=0.942
	51-60 years	62 (25.1)	5 (20.8)	
	61-70 years	97 (39.3)	10 (41.7)	
	71-80 years	69 (27.9)	7 (29.1)	
	>80 years	12 (4.9)	1 (4.2)	
Timing of surgery	Elective	244 (98.8)	21 (87.5)	FET=28.22;df=1;p=0.001
	Emergency	3 (1.2)	3 (12.5)	
Body mass index (BMI)*	Normal	203 (82.2%)	12 (50.0)	x <sup>2</sup> =52.82; df=2;p<0.0001
	Overweight	39 (15.8)	7 (29.2)	
	Obese	5 (2.0)	5 (20.8)	
Diabetes mellitus	Present	84 (34.0)	14 (58.3)	x <sup>2</sup> =0.009; df=1; p=0.008
	Absent	163 (66.0)	10 (41.7)	
Smoking	Yes	34 (13.8)	9 (37.5)	x <sup>2</sup> =12.62;df=1;p<0.0001
	No	213 (86.2)	15 (62.5)	
Urine culture**	UTI	47 (19.0)	7 (29.2)	x <sup>2</sup> =2.141; df=2; p=0.343
	Sterile pyuria <sup>#</sup>	91 (36.9)	8 (33.3)	
	No growth <sup>§</sup>	109 (44.1)	9 (37.5)	
Pre-op catheterization	Urethral	148 (59.9)	15 (62.5)	FET=31.754; p<0.0001
	Suprapubic	6 (2.4)	6 (25.0)	
	None	93 (37.7)	3 (12.5)	
Approach	Transvesical	102 (41.3)	10 (41.7)	x <sup>2</sup> =0.002;df=1;p=0.969
	Retropubic	145 (58.7)	14 (58.3)	
Skin incision	Lower midline	146 (59.1)	14 (58.3)	x <sup>2</sup> =0.002;df=1;p=0.969
	Pfannenstiel	101 (40.9%)	10 (41.7)	
Estimated blood loss	< 500mls	139 (56.3)	4 (16.7)	FET=33.93; p<0.0001
	500-999mls	79 (32.0)	7 (29.1)	
	1000-2000mls	29 (11.7)	13 (54.2)	
Level of surgeon	Consultant	126 (51.0)	10 (41.7)	x <sup>2</sup> =0.929;df=1;p=0.335
	Senior registrar	121 (49.0)	14 (58.3)	
Use of suprapubic catheter for irrigation post-operatively	Yes	24 (9.7)	8 (33.3)	x <sup>2</sup> =16.90;df=1; p<0.0001
	No	223 (90.3)	16 (66.7)	
Type of urethral catheter used post-operatively	Rubber catheter	179 (72.5)	21 (87.5)	FET=3.010; p=0.096
	Silicone coated	68 (27.5)	3 (12.5)	
Mode of bladder irrigation	Exogenous (normal saline)	211 (85.4)	22 (91.7)	FET=0.832; p=0.545
	Endogenous (diuresis)	36 (14.6)	2 (8.3)	
<b>TOTAL</b>		<b>247 (100.0)</b>	<b>24 (100.0)</b>	

x<sup>2</sup>=Chi-square; FET: Fisher's Exact Test; UTI: Urinary tract infection

\*BMI: Normal (18-24.9 kg/m<sup>2</sup>); overweight (25 - 30 kg/m<sup>2</sup>); obese (>30 kg/m<sup>2</sup>)

\*\*Urine culture taken during pre-operative evaluation at 2-6 weeks before surgery

<sup>#</sup>Sterile pyuria: negative urine culture despite elevated white cells in urine.

<sup>§</sup>No growth: negative urine culture with absent white cells in urine

## Discussion

The rate of SSI found in this study was 9.8% which is within the range of 1.2-35.0% that have been previously quoted in literature from different parts of the world<sup>7,8,9</sup>. The risk factors for post-prostatectomy SSI from this audit were emergency operation, obesity, diabetes mellitus (DM), smoking, pre-operative urethral/suprapubic catheterization, excessive haemorrhage and post-operative suprapubic bladder drainage. Age was not found to be a significant risk factor for SSI in our study ( $p=0.942$ ), similar to findings from other studies<sup>10,11</sup>. Age is however a controversial factor when considering risk factors for SSI. This is because investigators in the past have reported contradictory results concerning the relationship between increasing age and risk of SSI<sup>12</sup>. Some researchers affirm that increasing age is associated with a greater risk of SSI<sup>13</sup> while others believe factors indirectly related to age such as an increased prevalence of co-morbid conditions, increased severity of acute illness and decreased host response to bacterial invasion are the real reasons why older patients appear to have an increased risk of SSI<sup>14</sup>. A cohort by Kaye et al<sup>12</sup> involving 144,485 consecutive surgical patients and 72,139 procedures however concluded that increasing age independently predicted an increased risk of SSI only until age 65 years; while after 65 years, increasing age independently predicted a decreased risk of SSI.

The timing of surgery was a significant risk factor for the development of SSI from this study ( $p=0.001$ ) and all our patients who had their prostatectomy done as an emergency procedure developed SSI in the post-operative period. Though the reason for this is not clear, it may however not be unconnected with inability to fully optimize the patients before the procedure; which is usually not the case with an elective operation. There were however only few emergency cases in this series (1.2%) because our practice is to consider emergency prostatectomy only as a last resort in patients with life threatening haematuria unresponsive to conservative management who have been evaluated to exclude other possible causes of haematuria. Other researchers that have documented their experience with emergency prostatectomy however believe that in well selected patients, there is little or no additional risks from emergency prostatectomy when compared with the elective operation<sup>15</sup>.

More than half (58.3%) of the patients with SSI were diabetic, suggesting a significant role for DM as a contributory risk factor for SSI ( $p=0.008$ ). A possible mechanism for this is DM-associated immunosuppression leading to increased risk of SSI<sup>14</sup>. Though it is purely coincidental that the ratio of DM to non-DM patients in our series was 1:2, there is however a relatively high prevalence of type 2 DM in Nigeria, and a recent meta-analysis reported that the incidence of DM within the country was significantly higher than that of neighboring West African countries<sup>16</sup>.

Previous history of smoking was another significant risk factor for SSI in our study ( $p<0.0001$ ). Although a positive smoking history was uncommon in our patients, close to 2/3<sup>rd</sup> of those who smoked developed SSI. It is believed that smoking significantly increases the risk of developing SSI because the nicotine causes local tissue vasoconstriction, reduces oxygen carrying capacity of blood, limits the inflammatory response necessary for elimination of potentially infectious agents and has other adverse effects on wound healing<sup>17</sup>.

Other statistically significant predisposing factors for post-prostatectomy SSI encountered in our audit such as obesity ( $p<0.0001$ ), excessive blood loss ( $p<0.0001$ ), as well as pre-operative use of catheters are similar to what have been previously documented in literature by other researchers<sup>11,14,18</sup>. Van Roermund et al<sup>18</sup> in their study to evaluate the impact of obesity on outcome of open prostatectomy found higher rates of SSI in obese men, similar to the trend recorded in our study. A possible explanation for this is that adipose tissue is poorly vascularized and the subsequent effect of poor tissue oxygenation and reduced immune function is thought to increase the risk of SSI<sup>17</sup>. We also found that the higher the blood loss from the operation, the higher the risk of SSI. This seems to corroborate with the findings by Zargooshi<sup>8</sup> who reviewed 3,000 open prostatectomy procedures and reported that SSI was more prevalent in those patients whose operations were complicated by excessive bleeding, since these patients often needed blood transfusion and sometimes, re-operation.

Another risk factor for SSI encountered in our patients was the use of catheters in the pre-operative period. This is not surprising; as bacterial colonization is an inevitable

sequel of catheterization<sup>19</sup> and this is a potential source for organisms to gain access to the wound and cause SSI. This may be especially true in patients with suprapubic cystostomy (SPC) since all our patients on SPC at the time of (secondary) prostatectomy developed SSI. The use of a suprapubic catheter to aid bladder irrigation post-operatively equally increased the risk of SSI ( $p < 0.0001$ ), possibly due to similar increased risk of bacterial inoculation into the wound, aided by proximity of the suprapubic catheter to the wound site. It is however quite difficult to wean patients off use of catheter in the pre-operative period in our environment since many of them present late with severe lower urinary tract symptoms and complications such as urinary retention. An important issue that needs to be pointed out is however that we had more patients with sterile pyuria (91 patients; 36.9%) than those with confirmed UTI (47 patients; 19%) in our series. This may not be unconnected with the fact that some of the common antibiotics may sometimes be purchased without a prescription and abuse of such antibiotic medications possibly reduced the chances of isolating the culprit organism from the urine of patients with sterile pyuria.

The level of training and skills of the surgeon were not significant determining factors for SSI from our study ( $p = 0.335$ ). This is not in line with previous documentation from literature, but our finding may be partly explained by fact that the residents involved in performing the surgeries were already in the final stages of their residency training and were quite familiar with the procedure since it is done on a routine basis in our unit. The studies that documented lower infection rates in surgeries performed by consultants attributed this to better surgeon experience, shorter surgery duration and less bleeding from the procedure, as these factors may contribute to the development of SSI, either singly or in combination<sup>20</sup>. The surgical approach (transvesical vs retropubic), location of incision (lower midline vs pfannenstiel), catheter type (rubber vs silicone) and modality of irrigation (exogenous vs endogenous) were not statistically significant contributors to occurrence of SSI from this study.

As with any scientific research, there a number of confounding issues for this study. First is that all the patients were managed post-operatively on a general ward shared with other surgical sub-specialty units and this may have contributed adversely to the wound outcomes. Our second limitation was that being a retrospective study, we couldn't exhaust all the possible risk factors for SSI and

some of these such as the timing of admission and duration of surgery were not considered in our study.

## Conclusion

SSI is a recognized complication of open simple prostatectomy. Identified risk factors for its occurrence from this audit are emergency operation, obesity, DM, smoking, pre-operative urethral/suprapubic catheterization, excessive haemorrhage and post-operative suprapubic bladder drainage. Age, approach to prostatectomy (retropubic vs transvesical), incision type (lower midline vs pfannenstiel), level of the surgeon, catheter type and modality of irrigation were however not significant risk factors for post-prostatectomy SSI in this study.

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## Conflict of interest

None declared.

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