

PRE-INCISION SKIN ANTISEPSIS: PRACTICE PATTERNS AMONG SURGEONS IN NIGERIA

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ABSTRACT

Background: Although studies are rife on preoperative skin antisepsis, little is known about what surgeons in Nigeria practice.

Objective: To describe the pattern of practice of skin antisepsis prior to skin incision among surgeons in select tertiary hospitals in Nigeria.

Method: This was a questionnaire-based descriptive cross-sectional survey involving surgeons and surgeons in training in the departments of surgery, obstetrics and gynaecology (O&G), otorhinolaryngology (ENT), and oral & maxillofacial surgery (OMS) of 26 select tertiary hospitals from all six geopolitical zones in Nigeria. Data was analysed using version 23 of the SPSS for Windows.

Results: A total of 200 surgeons participated in the study with a male-to-female ratio of 9:1. The mean age was 37.2 ± 5.2 years. Senior registrars constituted 60.5% (n=121), followed by registrars (24%; n= 48) and consultants (15.5%; n= 31). The respondents performed a mean volume of 4 surgeries per week. Their most common practice is to perform skin preparation with 3 antiseptic agents with skin scrubbing lasting for 3-4 minutes. Skin scrubbing was performed for longer duration amongst consultants compared with senior registrars and registrars. Of all the surgical wounds encountered in their practice, 57% were clean. The common complications associated with the use of these antiseptic agents include allergic dermatitis and blisters.

Conclusion: The practice of pre-incision skin antisepsis varies widely among Nigerian surgeons. The majority use 3 antiseptic agents for skin antisepsis although most of the procedures performed were clean surgeries. We recommend further studies to standardize our practice locally.

Keywords: Skin antisepsis, Pre-incision, Pattern, Surgeons, Nigeria

INTRODUCTION

Before the mid-19th century, surgery was a dreaded venture due to the resultant complications like surgical site infection (SSI) at a time when little was known of the aetiological basis for these infections.¹ Demystification of this puzzle of surgical infection, on account of which surgeons rarely operated till the 1860's,² began when Louis Pasteur discovered the microbial basis for infection and tissue decay.³ Based on this discovery, Joseph Lister propounded that the presence of micro-organisms in surgical wounds was responsible for death in the post-operative period and then started treating wounds with carbolic acid, hence the first use of antiseptic agent was credited to him.³ Transient and resident microbes are ubiquitous on the human skin,⁴ These are commensals and opportunistic pathogens with no inherent ability to breach host barriers, unlike pathogenic microbes.⁵ Thus, a breach

in skin integrity during surgical incision leads to contamination of deeper tissues and subsequent infection of the surgical wound.

Skin antisepsis, the process wherein chemical agents are used to destroy or inhibit the growth of micro-organisms in or on living tissue⁶, is traditionally carried out before surgical skin incision to reduce microbial load and ultimately the burden of SSI.⁷⁻⁹ This stems from the fact that microbial infection rests on a tripod of microbial virulence, the host immune response and the infective dose of the inoculum.¹⁰ The United States Centers for Disease Control and Prevention (CDC) classifies surgical wounds according to their degree of contamination into clean (class I), clean contaminated (class II), contaminated (class III) and dirty (class IV) wounds. Clean wounds are uninfected

operative wounds wherein no inflammation was encountered and a hollow viscus is not breached. They are usually closed primarily. In clean-contaminated wounds, the respiratory, alimentary, genital, or urinary tracts are entered under controlled conditions and without spillage of contents to the operation site or wound. Included here are operations involving the biliary tract, appendix, vagina, and oropharynx. Contaminated wounds refer not only to operations with major breaks in sterile technique or gross spillage from the gastrointestinal tract, and incisions in which acute, non-purulent inflammation is encountered but also open, fresh, accidental wounds. Dirty wounds refer to traumatic wounds with retained devitalized tissue and those that involve existing clinical infection or perforated viscera. Here, the organisms causing postoperative infection were present in the operative field before the operation. Hence, pre-operative skin disinfection and cleaning is traditionally adopted as a key step in reducing surgical wound contamination and subsequent SSI based on a high level of evidence.¹¹⁻¹³ Commonly used antiseptics include alcohol-based (e.g. methylated spirit) iodophor-based (e.g. povidone-iodine) or chlorhexidine-based (e.g. Savlon, Hibitane) agents¹⁴. These reduce the microbial load prior to skin incision and also exert varying degrees of antimicrobial activity (microbistatic or microbicidal).

While the beneficial role of this pre-operative skin preparation has therefore been fully established in several studies and persisting debate being essentially limited to which agent or combination of agents provides superior antiseptic benefit,¹⁵ there is little information on what surgeons practice with respect to pre-incision skin antisepsis in Nigeria. The aim of this survey therefore was to describe what surgeons in Nigeria practise with respect to skin antisepsis before skin incision.

MATERIALS AND METHODS

This was a descriptive cross-sectional pilot survey carried out from May to July, 2019.

The study population were resident doctors (registrars & senior registrars) and consultants in the departments of surgery (including general surgery, urology, orthopaedics, neurosurgery, plastic surgery, cardiovascular and thoracic surgery and paediatric surgery), obstetrics & gynaecology, otorhinolaryngology, oral & maxillofacial surgery. Other surgeons with very little volume of skin surface surgeries like ophthalmologists were excluded from the surgery. Filling the questionnaire signified consent to participate in the study.

Pre-tested questionnaires were distributed to respondents from select tertiary hospitals of the

country using a convenience sampling method. Each respondent was provided with either a hard copy of the questionnaire or an online copy created using Google forms. Three categories of data were sought: biodata, surgical experience, practice of pre-incision skin antisepsis and complications observed with the use of skin antiseptic agents.

Data was analyzed using mean and standard deviation for continuous variables while categorical variables were analyzed with proportions. Version 23 of the SPSS for Windows (SPSS Inc. IL, USA) was used to analyze all data obtained from the study.

RESULTS

Biodata and socio-demographic profile

Two hundred surgeons were sampled across 26 tertiary institutions from the six geopolitical zones of Nigeria in the departments of Surgery, Obstetrics and Gynaecology, Oral & Maxillo-facial surgery and Otorhinolaryngology (ENT). The male to female ratio was 9:1 with a mean age of 37.2 ± 5.2 years. Most of them (60.5%, n =121) have been in surgical practice for 5-10 years while only 10% (n = 20) had practiced surgery for more than 10years (Table 1). The distribution of the respondents from the six geopolitical zones is illustrated in figure 1.

Table 1: Biodata and socio-demographic profile of respondents

| | Frequency (n = 200) | Percentage |
|---|------------------------|------------|
| Age (37.2 ± 5.2 years) | | |
| Below 35 years | 56 | 28.0 |
| 35 – 45 years | 133 | 66.5 |
| Above 45 years | 11 | 5.5 |
| Sex | | |
| Male | 180 | 90.0 |
| Female | 20 | 10.0 |
| Department | | |
| Surgery | 126 | 63.0 |
| Obstetrics & Gynecology | 22 | 11.0 |
| ENT | 41 | 20.5 |
| OMS | 11 | 5.5 |
| Cadre of Surgeon | | |
| Registrar | 48 | 24.0 |
| Senior registrar | 121 | 60.5 |
| Consultant | 31 | 15.5 |
| Duration of Practice (6.4 ± 4.7years) | | |
| Below 5 years | 59 | 29.5 |
| 5 – 10 years | 121 | 60.5 |
| Above 10 years | 20 | 10.0 |
| Year of Graduation (11.3 ± 4.6 years) | | |
| 5 – 9 years | 67 | 33.5 |
| 10 – 14 years | 107 | 53.5 |
| Above 14 years | 26 | 13.0 |

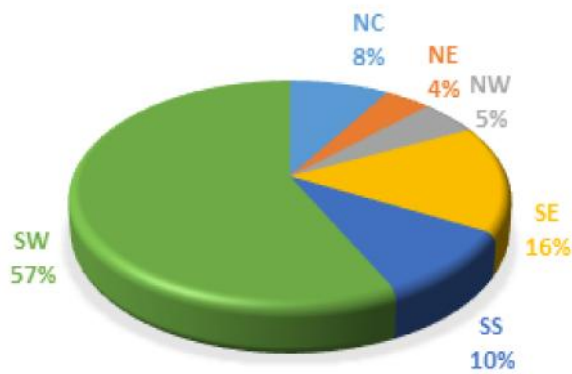


Fig. 1: Regional distribution of respondents and their institutions

(SW = South-West; NC = North-Central; NE = North-East; NW = North-West; SE = South-East; SS = South-South).

SW (Federal Teaching Hospital, Ido-Ekiti; Federal Medical Center, Abeokuta; Lagos University Teaching Hospital; National Orthopaedic Hospital Igbobi; Obafemi Awolowo University Teaching Hospital, Ile-Ife; University College Hospital, Ibadan; University of Ilorin Teaching Hospital)

NC (Dalhatu Araf Specialist Hospital, Lafija; Federal Medical Center, Lokoja; Jos University Teaching Hospital; National Hospital, Abuja; University of Abuja Teaching Hospital, Gwagwalada)

NE (Federal Medical Centre, Gombe; University of Maiduguri Teaching Hospital)

NW (44 Nigerian Army Reference Hospital, Kaduna; Ahmadu Bello University Teaching Hospital, Zaria; Amino Kano Teaching Hospital, Kano; National Orthopaedic Hospital, Dala)

SE (Alex Ekwueme Federal Teaching Hospital, Abakaliki; Imo State University Teaching Hospital; Nnamdi Azikiwe University Teaching Hospital, Nnewi; University of Nigeria Teaching Hospital, Enugu)

SS (University of Benin Teaching Hospital; University of Calabar Teaching Hospital; University of Port-Harcourt Teaching Hospital; University Uyo Teaching Hospital).

Table 2: Surgical experience and pattern of practice of skin antisepsis prior to skin incision

| | Frequency (n = 200) | Percentage |
|---|---------------------|------------|
| Number of Surgical Experience [\bar{x} = 4] | | |
| 1 – 2 surgeries/week | 46 | 23.0 |
| 3 – 4 surgeries/week | 91 | 45.5 |
| 5 – 6 surgeries/week | 41 | 20.5 |
| More than 6 surgeries/week | 22 | 11.0 |
| Most Common Type of Surgical Wound Encountered | | |
| Clean | 114 | 57.0 |
| Clean-contaminated | 66 | 33.0 |
| Contaminated | 14 | 7.0 |
| Dirty | 6 | 3.0 |
| Frequency of skin scrubbing with a soapy antiseptic solution during skin preparation | | |
| Once | 24 | 12.0 |
| Twice | 94 | 47.0 |
| Thrice | 53 | 26.5 |
| More than thrice | 13 | 6.5 |
| Don't use any soapy solution | 16 | 8.0 |
| Average Duration of Skin Preparation Prior to Incision | | |
| 1 – 2 minutes | 51 | 25.5 |
| 3 – 4 minutes | 97 | 48.5 |
| 5 minutes or more | 52 | 26.0 |
| Number of Agents Used for Skin Antisepsis | | |
| No agent | 5 | 2.5 |
| One agent | 19 | 9.5 |
| Two agents | 63 | 31.5 |
| Three agents | 113 | 56.5 |

Surgical experience

A mean volume of 4 surgeries per week was performed by the respondents with only 11% (n = 22) performing more than 6 surgeries per week. The most common surgical wound encountered in their practice is clean surgical wound (57%, n = 114). Ninety

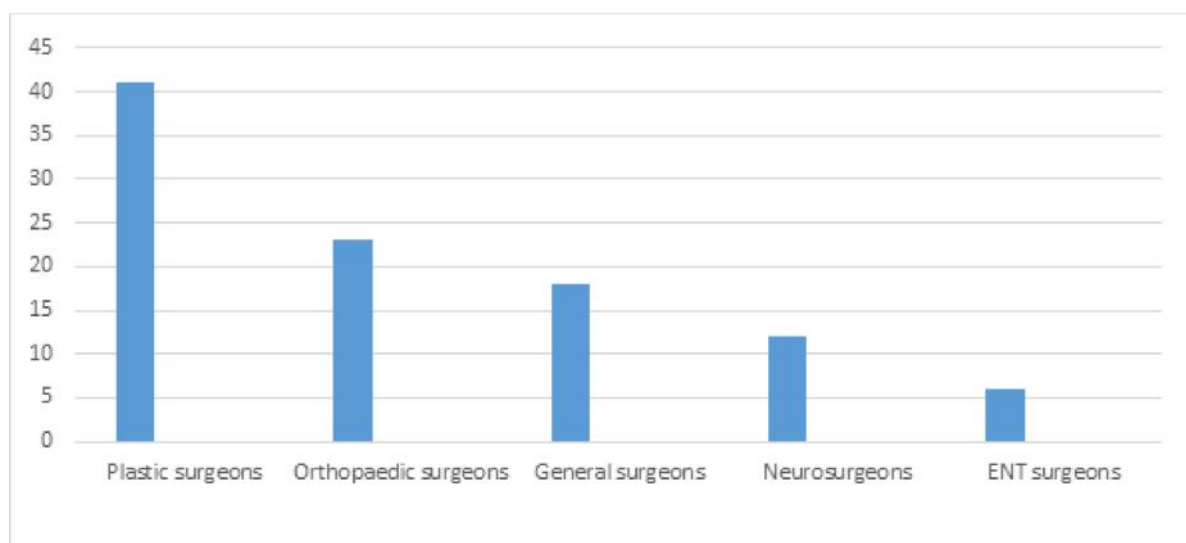


Fig 2: Distribution of surgeons who use a single antiseptic agent during skin prep

percent of the surgeries were clean and clean-contaminated surgeries while only 10% (n = 20) were contaminated and dirty. (Table 2).

Practice of pre-incision skin antiseptics

During skin preparation, 92% (n = 184) of surgeons perform skin scrubbing with a soapy antiseptic solution, with majority of them doing this twice during skin preparation (94%, n = 47). Among the 8% (n = 16) who do not scrub with a soapy antiseptic solution, 44% (n = 7) were plastic surgeons, followed by orthopaedic surgeons (31%, n = 5), general surgeons

(19%, n = 3) and O&G surgeons (6%, n = 1). Over 80% (n = 176) of surgeons use at least 2 antiseptic agents for skin antiseptics prior to skin incision, 9.5% use a single agent while 2.5% of them did not specify which agents they use for skin preparation. Among those who use a single agent (Savlon or Povidone iodine or methylated spirit), 41% (n = 8) were plastic surgeons, followed by orthopaedic surgeons (23%, n = 5), general surgeons (18%, n = 3), Neurosurgeons (12%, n = 2) and ENT surgeons (6%, n = 1) as shown in figure 2.

Table 3: Order in which respondents applied pre-incision skin antiseptic agents

| Antiseptic agent | Frequency (n = 200) | Percentage |
|-------------------|---------------------|------------|
| First | | |
| Savlon | 176 | 88 |
| Povidone iodine | 19 | 9.5 |
| Methylated spirit | 1 | 0.5 |
| Not stated | 4 | 2 |
| Second | | |
| Savlon | 0 | 0 |
| Povidone iodine | 121 | 60.5 |
| Methylated spirit | 75 | 37.5 |
| Not stated | 4 | 2 |
| Third | | |
| Savlon | 0 | 0 |
| Povidone iodine | 44 | 22 |
| Methylated spirit | 109 | 54.5 |
| Nothing | 43 | 21.5 |
| Not stated | 4 | 2 |

The most commonly used antiseptic agents for skin preparation prior to skin incision were Savlon, Povidone iodine and methylated spirit, used by 84.5%, 80% and 70% of respondents respectively. Table 3 shows the order in which respondents applied pre-incision skin antiseptic agents. The first agent used by majority of them (88%, n = 176) was savlon, while the most commonly used second and third agents were povidone iodine (60.5%, n = 120) and methylated spirit (54.5%, n = 109) respectively. Among the 4 departments studied, majority of the respondents used 3 or more antiseptic agents for skin preparation except in general surgery where there was equal distribution of those who use 3 or more agents and those who use less than 3 agents (Fig 3).

Duration and complications of skin antiseptics

As shown in table 4, a higher proportion of consultants scrub for 5 minutes or more compared to senior registrars and registrars with a statistically significant difference in the duration of skin preparation among the cadres of surgeons (41.9% vs 24.0% vs 20.8%; p

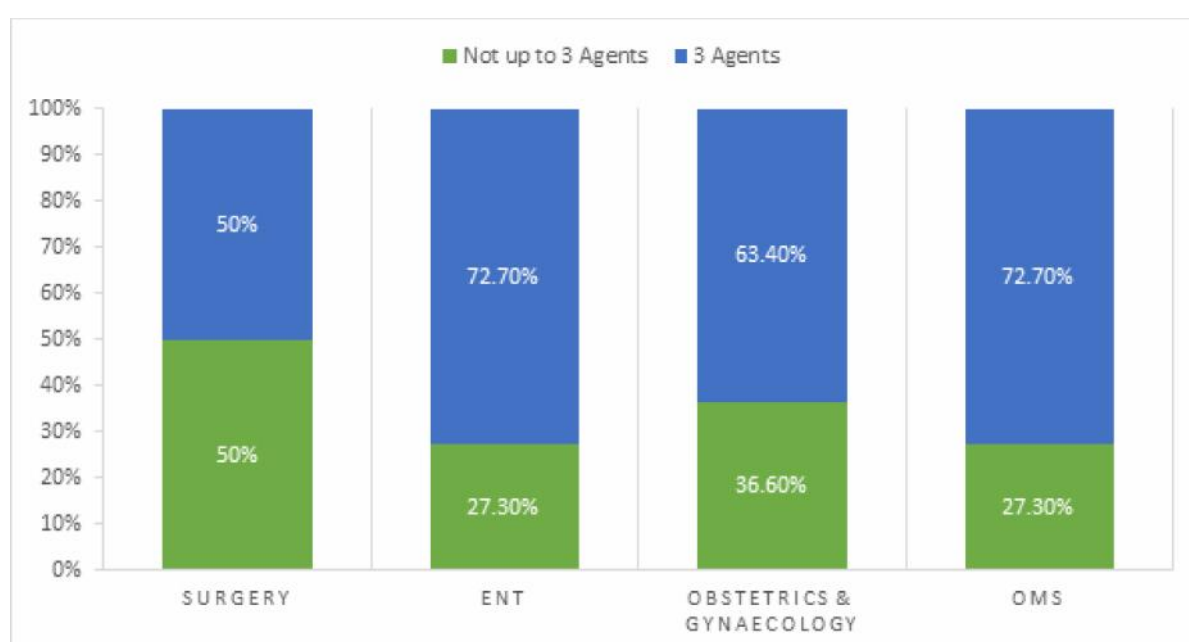


Fig 3: Number of agents used for skin preparation among the departments

Table 4: Duration of skin preparation prior to incision by cadre of surgeon

| | | Cadre | | | p-value |
|--|-------------|------------|------------------|------------|---------|
| | | Registrar | Senior registrar | Consultant | |
| | 1-2 minutes | 10 (19.6%) | 34 (66.7%) | 7 (13.7%) | <0.001 |
| Average duration of pre-incision skin preparation | 3-4 minutes | 28 (28.9%) | 58 (59.8%) | 11 (11.3%) | <0.001 |
| | ≥5 minutes | 10 (19.2%) | 29 (55.8%) | 13 (25.0%) | 0.02 |

= 0.02). Table 5 shows that 34.5% of surgeons reported complications with the use of skin antiseptics, the most common of which was allergic dermatitis (28%).

Table 5: Complications of skin antiseptics

| Complications | Frequency (n = 200) | Percentage |
|--|---------------------|------------|
| Encountered complications | 69 | 34.5 |
| No complications | 131 | 65.5 |
| Specific complications | | |
| Allergic dermatitis | 56 | 28.0 |
| Blisters | 27 | 13.5 |
| Both allergic dermatitis & blisters | 14 | 7.0 |
| Others (skin discoloration and skin burns) | 2 | 1.0 |

DISCUSSION

Skin preparation prior to skin incision is a standard surgical protocol with ongoing debate largely concentrated on which agent or combination of agents provides the best post-operative outcome. Whilst there is diversity in not only the antiseptic agents used and their pattern of use among surgeons in general and even within same surgical subspecialty in particular^{16,17}, we do not have a data base on what is practiced in Nigeria. In this pilot study, we took a survey of the pattern of practice of skin antiseptics before skin incision among surgeons in four surgical departments of select tertiary hospitals was carried out to generate baseline data for future studies on the topic.

Male surgeons dominated the respondents, most of whom were in their third and fourth decades of life with only 5% of them above 45 years, similar to the findings in local studies that there are fewer female doctors in specialty-based medical practice¹⁸ with

under-representation of women in surgery.¹⁹ Most of the respondents were senior registrars while consultants constituted the least frequency, a reflection of the higher population of surgeons in training compared to consultants in Nigeria.

Over 55% of the surgeons were from the South-western part of the country. This may be due to the fact that a convenience sampling of the tertiary institutions was done with 3 of the major tertiary hospitals' resident in the South-western region, wherein the authors practice.

Ninety percent of surgical wounds encountered by the respondents were clean and clean-contaminated wounds with only 10% being contaminated and dirty wounds. This portends a trend towards more elective than emergency procedures, most of which were likely to involve contaminated and dirty wounds.

Although the observed pattern of skin antiseptics prior to skin incision in our study shows a variation among the surgeons, majority of them scrub with a soapy antiseptic solution twice during skin preparation, with savlon, povidone iodine and methylated spirit being the commonest first, second and third agents respectively used during skin preparation. In our institution, most surgeons would scrub the surgical site skin twice with a soapy solution (usually 0.3% chlorhexidine + 3% cetrimide, otherwise known as Savlon), dry the skin, then paint the surgical site with 5 or 10% povidone iodine before application of 70% isopropyl alcohol prior to skin incision. Although this pattern of skin preparation has been reported in the developed clime,²⁰ inter-disciplinary variation exists in this practice. For example, while a few of the respondents do not scrub with a soapy solution at all before skin incision, one-third of them scrubbed with a soapy solution 3 or more times. Of the few that do not scrub with a soapy antiseptic solution, majority

were plastic and orthopaedic surgeons. Similarly, majority of surgeons who use a single antiseptic agent for skin preparation are plastic surgeons, followed by orthopaedic surgeons. While the reason for this trend among plastic and orthopaedic surgeons may not be evident from our study, some studies in patients undergoing orthopaedic surgery have however shown the superiority of a 2-agent skin preparation over a single agent (Chlorhexidine gluconate + povidone iodine vs povidone-iodine alone²⁰ or Chlorhexidine + isopropyl alcohol vs povidone-iodine alone²¹). However, a randomized controlled study by Obamuyide *et al.* comparing chlorhexidine-alcohol and povidone-iodine as single agents for skin preparation in patients undergoing orthopaedic and trauma surgery in Ibadan, Nigeria showed no statistically significant superiority of one over the other in terms of post-operative skin microbial load and proportion of positive cultures.²² Similarly, Veiga *et al.* reported no statistically significant difference in post-operative infection rates between patients for whom alcohol solution of 10% povidone-iodine was used for skin preparation and those in whom 0.5% chlorhexidine was used during elective and clean plastic surgery procedures.²³ The inter-disciplinary variation in pre-incision skin antisepsis extends beyond choice of antiseptic agent to method of their application, either in concentric or forth-and-back pattern. The variation in the method of antiseptic solutions, concentric circles or forth-and-back pattern, and the different solutions available calls for more studies.²⁴

While a less robust skin preparation has been advocated by some researchers particularly in a developing country,²⁵ others have affirmed the need for a more thorough protocol. A prospective randomized study by Meier *et al.* in Ogbomoso, Nigeria reported that pre-incision skin preparation with locally available, inexpensive market soap and methylated spirit had comparable post-operative wound infection compared to using an imported povidone iodine (5.1% vs. 5.9%, $p = 1.000$).²⁵ In contrast, Morrison *et al.*²⁶ have demonstrated in a prospective randomized double-blind study at Philadelphia, USA, that reapplication of skin antiseptics (a 3-step process, in which 7.5% povidone-iodine scrub was first applied, followed by 10% iodine paint, and finally 75% isopropyl alcohol.) after draping and before the application of iodophor-impregnated incision draping resulted in a significant reduction in the rate of SSI in patients undergoing elective total joint arthroplasty than in controls (who had a single application of alcohol and povidone-iodine before draping). In this study, over 60% of the respondents in each of ENT, O&G and OMS reported using 3 or more agents for skin

preparation except those in general surgery department. This disparity between surgery and other departments under study may be due to the fact that majority of respondents who use less than 3 agents were found in plastic and orthopaedic divisions of surgery.

The common agents used by over two-third of the respondents were savlon, povidone iodine and methylated spirit. The superiority of these agents over one another has remained an area of debate in many studies.^{27,28}

This study is not without limitation. The convenience sampling technique in this study skewed the constitution of respondents towards one geo-political zone (the South-west) with a potential to bias the overall observed practice towards this region. Again, this study was limited to only surgeons in the tertiary hospital, most of which were federal teaching hospitals, excluding state teaching hospitals, secondary and primary health institutions. It may therefore not be generalizable to all Nigerian surgeons.

CONCLUSION

The commonest surgical wounds encountered by Nigerian surgeons are clean wounds, followed by clean contaminated wounds. In spite of this, majority of our surgeons use three antiseptic agents to perform pre-incision skin antisepsis, the common ones being savlon, povidone iodine and methylated spirit. The most common order of applying these agents is to use savlon, followed by povidone iodine, then methylated spirit. Scrubbing with a soapy antiseptic solution is usually done twice, each lasting commonly for 3-4 minutes. We recommend further studies to validate which agent or combination of agents and their pattern of application produce best outcome in the Nigerian population.

Conflict of interest

The authors have no conflict of interest to declare in this study

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