

Infection

Evaluation of the skin flora after chlorhexidine and povidone-iodine preparation in neurosurgical practice

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Abstract

Background: Currently, there are various antiseptics used for cleaning the skin before surgery, but there is no standard procedure in practice. Chlorhexidine and povidone-iodine are the most preferred compounds among antiseptics. Both are proved to be safe and effective for skin disinfection. In this study, our aim was to investigate the combined effects of chlorhexidine and povidone-iodine on the skin's flora before neurosurgical intervention, consecutively.

Methods: Randomly, 50 cranial and 50 spine neurosurgery cases were assigned to the study. The first culture was obtained after hair removal and before cleaning the skin with any antiseptic. The second culture was obtained after the skin had been cleaned with chlorhexidine for 3 minutes. Then, the skin was cleaned twice with povidone-iodine for 30 seconds, and the third and fourth cultures were taken from the skin incision area. Bacteria were identified by means of standard laboratory identification methods. Positive culture results were compared statistically among order of cultures obtained.

Results: In the first culture evaluation, 39 (33 cnS, 6 *Staphylococcus aureus*) of 50 cranial samples and 37 (33 cnS, 4 *S. aureus*) of 50 spine samples showed reproduction. In the second culture, 9 cranial and 5 spine samples showed reproduction of cnS. In the third and fourth cultures, no growth was observed ($P < .001$).

Conclusion: Three minutes' cleaning of the incision area with chlorhexidine, followed by 30-second cleaning with povidone-iodine, could be a sufficient disinfection procedure for preoperative preparation of the skin in patients undergoing a neurosurgical procedure.

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Keywords:

Antisepsis; Chlorhexidine; Neurosurgery; Povidone-iodine; Skin disinfection

1. Introduction

Cleaning of the skin with antiseptics before the surgical intervention clearly reduces the infection risk. Currently, several methods with various antiseptics are being used for this purpose [4,10,17,18,25,26,31]. The skin cannot be entirely sterilized because approximately 20% of the resident

flora is beyond the reach of surgical scrubs and antiseptics [19,30]. The aim of surgical preparation of the skin with antiseptics is to remove transient and pathogenic microorganisms on the skin surface and to reduce the resident flora to a low level. Over the years, a wide range of substances have been used in skin preparation, including phenol, tincture of iodine, surgical spirit/ethanol/isopropanol, Merthiolate, hexachlorophene, quaternary ammonium compounds, iodophor, chlorhexidine, and octenidine dihydrochloride/phenoxo ethanol [2,16,21]. Among these, chlorhexidine and povidone-iodine are most frequently preferred in institutions. Chlorhexidine is a very safe, effective, and useful antiseptic as a skin disinfectant

Abbreviations: cnS, coagulase-negative *Staphylococcus*.

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[1,12,17,21,31]. Povidone-iodine, a complex of polyvinylpyrrolidone and triiodine ions, is also widely used as an antiseptic for skin preparation [5,9,12,17,25,28,31–33]. Although both substances are generally preferred, there is still no standard procedure of using them for cleaning the skin incision area in neurosurgery practice [29,31]. In this study, our aim was to investigate the effect of chlorhexidine and povidone-iodine on the skin's flora before spinal or cranial surgical intervention, consecutively. At the same time, we wanted to determine how many times and how long would be sufficient for cleaning of the skin with chlorhexidine followed by povidone-iodine before spinal and cranial surgery.

2. Methods

This prospective study was carried out between 2002 and 2005 at the Department of Neurosurgery, University of Dicle, Diyarbakir, Turkey. Fifty cranial and 50 spinal neurosurgery cases were randomly included in the study, except for patients with an infective or open wound, immunologic deficiency disease, or diabetes. All patients took a shower 24 hours before the surgery. All samples were obtained by the same physician by using a regular cotton swab method. The first culture was obtained in the operating room immediately after shaving hairs. The second culture was obtained after the skin was cleaned with 15% chlorhexidine (Salvasol®; Turkuaz Medical, Istanbul, Turkey) by using sterile sponge for 3 minutes. Thereafter, the skin was cleaned twice with 10% povidone-iodine (Betadine®; Kansuk, Istanbul, Turkey) for 30 seconds, and third and fourth cultures were obtained after each povidone-iodine application. The samples were evaluated in the microbiology department at Dicle University. No skin reaction or allergy and postoperative infection were observed among patients.

2.1. Technique of culture

A sterile cotton swab was moistened with sterile buffered transport medium (composed of 0.075 mol/L phosphate buffer, pH 7.9; 0.1% polysorbate 80; 0.1% sodium

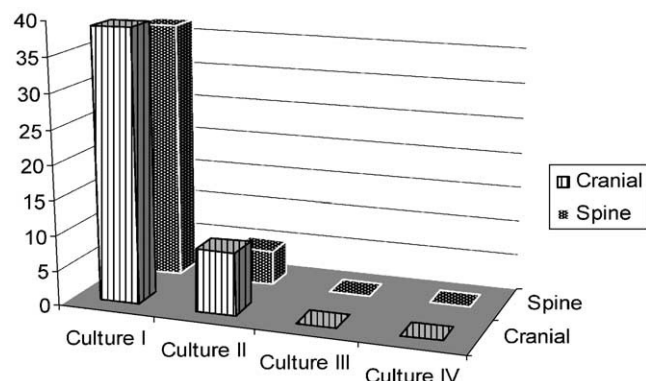


Fig. 1. Graphic showing culture results. Significant reduction of agents of skin's flora was evident after stepwise disinfection procedure.

Table 1
Growth in cultures

Region	First culture	Second culture	Third culture	Fourth culture
Cranial	39	9	–	–
Spine	37	5	–	–
Total	76	14	–	–

Both group culture results were analyzed statistically, and significant levels were determined ($P < .001$).

thiosulfate; and 0.3% lecithin), and a quarter-sized area was swabbed in a circular motion, with approximately the same pressure applied when a pencil eraser is used. Each swab was placed in a vial containing 2.0 mL of the transport medium and was plated within 2 hours. Samples were diluted 10-fold with the transport medium, up to 10^{-3} , and were spread plated onto 5% sheep blood agar and eosin–methylen blue media for isolation of gram-negative rods. Plates were incubated at 37°C for 48 hours. Bacteria were identified by means of standard laboratory identification methods [3,8].

2.2. Statistical methods

All culture results were analyzed by Wilcoxon signed rank test, and significant levels were determined as P value less than .001. Frequencies were calculated for culture agents. Statistical analyses were carried out by using the statistical packages for SPSS 15.0 for Windows (SPSS Inc, Chicago, Ill).

3. Results

In the first culture evaluations, 39 (78%) of 50 cranial samples and 37 (74%) of 50 spine samples showed growth (Fig. 1). The second culture evaluation revealed growth in 9 (18%) cranial and 5 (10%) spine samples. The third and fourth culture evaluations did not show any growth. Both group culture results were analyzed statistically, and significant levels were determined: cranial (first and second cultures), $P < .001$; cranial (second and third cultures), $P < .001$; spine (first and second cultures), $P < .001$; and spine (second and third cultures), $P < .001$ (Table 1).

In the first culture, 33 of 39 positive cranial samples were cnS, and 6 of them were *S aureus*; 33 of 37 positive spine samples were cnS, and 4 of them were *S aureus*. In the second culture, a total of 14 samples (9 cranial, 5 spinal) showed cnS growth. Both groups' cultures were analyzed by Wilcoxon

Table 2
Agents growing in the cultures

Region	First culture agent		Second culture agent	
	cnS	<i>S aureus</i>	cnS	<i>S aureus</i>
Cranial	33	6	9	–
Spine	23	4	5	–
Total	56	10	14	–

Both groups' cultures were analyzed, and significant levels were determined ($P < .001$).

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