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Povidone-Iodine Antisepsis in Lumbar Disc Surgery

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ABSTRACT

Postoperative surgical site infection still constitutes a major concern in spinal surgery and related with poor outcome. We aimed to investigate the effect of povidone-iodine (PVP-I) on skin colonization in lumbar disc herniation (LDH) surgery.
Adult patients scheduled for LDH surgery were included in the study. Three skin swab cultures were taken when lying on the operating table (culture 1), after PVP-I application (culture 2), and at the end of the operation (culture 3). The effect of PVP-I and other independent predictors on skin culture was analyzed.
A total of 62 [28 (45%) female, mean age 47±13 years] patients were included. Only male sex and taking shower before the surgery have been found to be independent factors for affecting culture 1 growth while adjusted to age, body mass index, smoking, preoperative hospital stay, and surgery site shaving [OR (95% CI): 7.8 (1.4-41.9), p=0.016; OR (95% CI): 0.34 (0.003-0.35), p=0.005]. After PVP-I, the growth frequency of culture 2 decreased significantly compared to culture 1 [8 (13%) vs. 43 (70%), p<0.001]. However, culture 3 positivity rate was similar to culture 2 (p=0.219).
In preoperative sterilization of lumbar disc surgery, PVP-I significantly reduces skin colonization both immediately after application and at the end of the operation.

Keywords: Povidone-iodine, antisepsis, lumbar disc surgery

Introduction

Both its high prevalence and contribution to disability make lumber disc herniation (LDH) one of the most commonly encountered disease in neurosurgery and cause more than $ 100 billion of annual cost in the USA (1). Despite advances in brand new neurosurgery techniques, post-operational surgical site infection (SSI) still constitutes a major concern. Both endogen and exogen infectious agents can cause devastating complication after neurosurgery. We aimed to investigate the effect of povidone-iodine (PVP-I) on infectious agents grown at locally obtained cultures in a timely manner.

Materials and Methods

Adult patients scheduled for LDH surgery between February 2021 to January 2022 were included in the study. Socio-demographic data, smoking, comorbidities, herniated disc type, pre/postoperative hospital stay, preoperative showering, surgical site shaving, operation time, intraoperative bleeding were obtained. A total of 3 skin swab cultures were taken when lying on the operating table (culture 1), after PVP-I application (culture 2), and at the end of the operation (culture 3). PVP-I was expansively applied to the operation area three times circularly. All patients underwent lumbar microdiscectomy by different surgeons. Ethics committee approval for the study was obtained from the local ethics committee (Date: 10.02.2021, decision number: 06).

Outcomes: Primary outcome was to detect whether PVP-I is effective in surgical field antisepsis. Secondary outcome was to describe predictive risk factors with respect to the skin flora preoperatively and immediately after the operation.

Statistical Analysis: All values are represented as frequency and percentage, mean ± standard deviation (SD) as appropriate. Distribution normality was analyzed with the Kolmogorov-Smirnov and Shapiro-Wilk tests properly. Independent categorical variables were analyzed χ^2/exact tests while McNemar and Cochran's Q tests were used for dependents. Multivariate logistic regression analysis was performed for detecting independent risk factors predicting culture growths. Hosmer-Lemeshow goodness of fit statistics were used to assess model fit. A p value of < 0.05 was accepted as significant. All analyzes were calculated with SPSS 23 IBM® statistics program.

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Results

A total of 62 [Female: 28 (45%)] patients were included into the study. The mean age was 47±13 years. Only three (5%) patients had a recurrent LDH. Herniated disc type was detected to be a protrusion in 16 (26%), extrusion in 42 (68%), and sequestration in four (7%). Surgical site shaving has been performed in 32 patients prior to surgery and in 8 patients before the day of surgery while no surgical site shaving has been achieved in 22 patients. 42 (68%) patients took a shower before the day of surgery while 20 (32%) did not.

Growth in culture 1 has occured in 43 (70%) patients. The most frequent (31%) offending agent was coagulase negative staphylococcus (CoNS). While there was no relationship between a positive culture 1 growth and surgical site shaving (p=0.866), more frequent positive culture 1 growth was detected in patient who did not take a shower prior to surgery [18 (90%) vs. 25 (60%), p=0.019]. Only male sex and taking shower before the surgery have been found to be independent factors for affecting culture 1 growth while adjusted to age, body mass index, smoking, preoperative hospital stay, and surgery site shaving [OR (95% CI): 7.8 (1.4-41.9), p=0.016; OR (95% CI): 0.34 (0.003-0.35), p=0.005].

After PVP-I, the growth frequency of culture 2 decreased significantly compared to culture 1 [8 (13%) vs. 43 (70%), p<0.001]. However, culture 3 positivity rate was similar to culture 2 (p=0.219). There was no relationship between culture 3 results and the amount of intraoperative bleeding or duration of surgery (70% were performed in the 60-120 minutes range). Although Staphylococcus aureus, diphtheroid bacilli, and fungi were eradicated after PVP-I, a re-increase in skin contamination, Staphylococcus epidermidis, Stenotrophomonas maltophilia, and other microorganisms was noted in culture 3 (table 1). No SSI was observed in any patient in the postoperative follow-up.

Discussion

In this study, we analyzed skin sterilization with PVP-I in lumbar microdiscectomy. The positivity rate was significantly reduced in cultures taken after PVP-I. Male gender and not showering before the operation were found to be independent predictors for basal skin microorganism density which CoNS makes up the vast majority. No relationship was shown between the postoperative skin flora with the amount of intraoperative bleeding or the operation period.

Postoperative SSI, which occurs in the range of 0.7-16%, remains a major concern in spinal surgery and is associated with increased cost, length of hospital stay, morbidity and mortality (2). One of the main determining factors for SSI is antiseptics. PVP-I is widely and safely used in preoperative skin sterilization and has antibacterial, antiviral and antifugal activity (3). However, data in spinal surgery are limited and the ideal antiseptic has not been demonstrated. In a prospective study comparing PVP-I and chlorhexidine gluconate (CHG), no significant difference was found in the incidence of spinal SSI (4). In another randomized controlled study, sequential administration of PVP-I and CHG was shown to be more effective in surgical wound contamination than PVP-I alone (5). SSI definition, antiseptic selection, or anatomical localization may contribute to postoperative wound infection (6). Moreover, the efficacy of antiseptics may vary depending on the surgical location. On the other hand, SSI was mostly used as a primary outcome in studies, which can be affected by confounding factors such as surgery and suture technique, presence of drainage, operation time, or postoperative wound care (7). In this study, specific to LDH surgery, sequentially skin cultures were accepted as the primary outcome.

In our cohort, although *Staphylococcus aureus,* diphtheroid bacilli, and fungi were eradicated after PVP-I, a re-increase in skin contamination, Staphylococcus epidermidis, Stenotrophomonas maltophilia, and other microorganisms was noted at the end of operation. Despite culture 3 was not associated with the operation period, this may be due to the duration of the antiseptic effect, contamination from the environment, or the surgical team.

One of the most important limitations of the study is that it was a single-center study with a small number of patients, and therefore the subgroup data were insufficient. Another limiting factor is the inability to compare SSI and culture results.

Consequently, in preoperative sterilization of lumbar disc surgery, PVP-I significantly reduces skin colonization both immediately after application and at the end of the operation.

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Conflict of interest declaration: The authors declare that they have no conflict of interest.

Table 1. Comparison of culture 1, 2 and 3 growth (total number of 62

Microorganisms	Culture 1, n (%)	Culture 2, n (%)	Culture 3, n (%)	p value*
No growth	19 (30.6)	54 (87.1)	50 (80.6)	<0.001
Skin contamination	9 (14.5)	0 (0)	5 (8.1)	0.006
CoNS	25 (40.3)	5 (8.1)	3 (4.8)	<0.001
Staphylococcus aureus	3 (4.8)	0 (0)	0 (0)	0.05
Staphylococcus epidermidis	2 (3.2)	0 (0)	2 (3.2)	0.264
Stenotrophomonas maltophilia	5 (8.1)	1 (1.6)	2 (3.2)	0.039
Diphtheroid bacilli	3 (4.8)	0 (0)	0 (0)	0.05
Fungi	1 (1.6)	0 (0)	0 (0)	0.368
Others	9 (14.5)	2 (3.2)	6 (9.7)	0.035

*Cochran's Q test statistics. CoNS, Coagulase negative staphylococci

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List of abbreviations: CHG, chlorhexidine gluconate; CoNS, coagulase negative staphylococcus; LDH, lumber disc herniation; PVP-I, povidone-iodine; SSI, surgical site infection.

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