Research Article

The effect of Povidone-iodine on Peridural Fibrosis in Spinal Surgery

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Summary

Aim: The purpose of this study was to evaluate whether povidone-iodine has any incremental effect on peridural fibrosis in spinal surgery.

Materials and methods: 24 albino rats were used for this experimental study. They were divided into three groups. In the first group (n=8) only Th8-Th12 laminectomy was performed (control group). In the second group (n=8), laminectomy area was irrigated with 2.5% concentrated povidone-iodine for 30s seconds. In the third group (n=8), laminectomy area was irrigated with 10% concentrated povidone-iodine for 30 seconds. In pathological specimens, fibrosis length and fibrosis area was calculated and compared between groups.

Results: Peridural fibrosis length and fibrosis area didn't show statistically significant difference between all groups.

Conclusion: Povidone-iodine has not increasing effect on peridural fibrosis so it may be safely used in spinal surgery when it is needed.

Key words: Povidone-iodine, peridural fibrosis, spinal surgery, laminectomy

Spinal Cerrahi Uygulamalarında Povidon-iyotun Peridural Fibrozis Üzerine Etkisi: Deneysel Çalışma

Özet

Amaç: Bu çalışmanın amacı povidon-iyotun spinal cerrahisi uygulamalarında peridural fibrozisi artırmaya görülmediğini araştırmaktı.

Materyal ve metod: Bu deneysel çalışmada Wistar albino cinsi 24 sığan kullanıldı. Bunlar üç gruba ayrıldı. Birinci grupta (n=8) sadece Th8-12 arası laimektomi yapıldı (kontrol grubu). İkinci grupta (n=8) laminektomi alanı 30 saniye boyunca %2,5luk povidon-iyot ile irigeye edildi. Üçüncü grupta (n=8) laminektomi alanı 30 saniye boyunca %10 povidon-iyot ile irigeye edildi. 8 hafta sonra çıkanlar sakrifiye edildi. Patolojik preparatlarda fibrozis uzunluğu, fibrozis alanı ölçüldü ve gruplar arasında karşılaştırıldı.

Sonuçlar: Peridural fibrozis uzunluk ve alan ölçümleri üç grup arasında farklılık göstermemiştir.

Yargs: Povidon-iyoton peridural fibrozisi artırıcı etkisi yoktur. Bu nedenle, spinal cerrahisi uygulamalarında gerekli olduğu takdirde güvenle kullanılabilir.

Anahtar Kelimeler: Povidon-iyot, peridural fibrozis, spinal cerrahi, laminektomi
INTRODUCTION

Povidone-iodine is an iodine based compound used for the antisepsis of the surgical sites in spine surgery as in other surgical sites\(^\text{(5,7,10,13)}\). However, it is also used in infected cases or in the cases that considered suspicious infection transmission during the operation (such as particle transmission from the ceiling of the operating room, sweat of surgical team, etc) for the irrigation of the deep operation area including epidural space\(^\text{(4)}\).

The effects of povidone-iodine on the development of adhesion have been studied in different thorax and abdomen studies. It was used in a small number of human studies with the aim of pleurodesis. These studies reported successful results\(^\text{(6,16)}\). The mechanisms of pelurodesis were reported as pleural injury, inflammation, and fibrosis\(^\text{(6)}\).

A clinical study reporting the safety of povidone-iodine in terms of fusion rate, improvement of pain score, function score, and ambulatory group was reported in the literature\(^\text{(4)}\). However, there is no study in the literature whether povidone-iodine has a similar incremental effect on peridural fibrosis in spinal surgery. In the present study we aimed to evaluate such an effect of povidone-iodine in an experimental model.

MATERIAL AND METHODS

This study was performed after approval of the local ethics committee of Adnan Menderes University Laboratory animals (B.30.2.ADÜ.00.00.00/050.04/2010/29). 24 Wistar albino adult female rats weighing 230±20 gram were used. They were divided into three groups each containing eight animals. Group I one was the control group in them only Th8-Th10 laminectomy was performed (n=8). In group II (n=8), epidural space was washed with 2.5% concentrated povidone-iodine (Poviodeks, Kimpa, Istanbul) during 30 seconds after laminectomy. In group III (n=8), epidural space was washed with 10% concentrated povidone-iodine during 30 seconds after laminectomy. For the anesthesia of animals, 8 mg/kg ketamine (Alfamine 10%, Ege Vet Hayvancilik Bornova-Izmir, Alfasan International BV Holland) and 1 mg/kg xylazin (Alazyne 2%, Ege Vet Hayvancilik Bornova-Izmir, Alfasan International BV Holland) were used intraperitoneally. After 8 weeks of operation, rats were sacrificed and related vertebral column was removed. Rats were sacrificed with high dose of thiopental sodium (Pental, Ulagay, Istanbul-Turkey). Before the first operation and sacrification rats were weighed and weight changes were noted.

Pathological Evaluation

Removed vertebral columns were fixed with 10% of buffered formalin and after that it was decalcified with 10% formic acid during four days. After decalcification, tissue samples were taken from laminectomy areas, they washed with tap water after that they passed through routine tissue processing, three different sections for each case 5 µm in thickness were taken and stained with hematoxilen-eozin and measurements of three sections were averaged, consecutively. All measurements were performed on the computer with the DP-BSW (Microscope digital camera software) program which connected with microscope (Olympus DP 25). Peridural fibrosis tissue area was calculated as µm\(^2\). Additionally, the depth between the two bony structure (laminectomy area) (µm), widest length of the fibrosis (µm), and widest subdural space (µm) were measured (Figure 1).
**Statistical analysis**

The statistical analyses were performed using software SPSS 14.0 (SPSS Inc., Chicago, IL, USA). Area of fibrosis (μm²), the rate of the fibrosis area (μm²) to deepest distance between two bony structures (μm), widest length of the fibrosis (μm) with a subdural widest distance (μm) the difference were examined with Kruskal-Wallis test. Two-tailed P-values of less than 0.05 were considered to indicate statistical significance.

**RESULTS**

The results of fibrosis area, deepest distance between two bony structures, widest length of the fibrosis, and widest subdural space were shown in Table 1. There was no significant difference between groups in terms of fibrosis area (p>0.05). Similarly, we didn't observe any significant difference between groups in terms of fibrosis area to deepest distance between two bony structures (p>0.005). Also, when groups compared in terms of widest length of the fibrosis and widest subdural space, we didn't detect statistically significant difference (p>0.05).
Table 1: The results of fibrosis area (d), deepest distance between two bony structures (a), widest length of the fibrosis (c).

<table>
<thead>
<tr>
<th></th>
<th>Group I</th>
<th>Group II</th>
<th>Group III</th>
<th>p</th>
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<tbody>
<tr>
<td></td>
<td>(Median 25-75 percentile)</td>
<td>(Median 25-75 percentile)</td>
<td>(Median 25-75 percentile)</td>
<td></td>
</tr>
<tr>
<td>d</td>
<td>718075 (486467- 2020621)</td>
<td>678547,5 (188491,25-1480680)</td>
<td>173190 (388321- 1622838)</td>
<td>0,816</td>
</tr>
<tr>
<td>d/a</td>
<td>1242,3 (474,7- 1715,2)</td>
<td>666,3 (298,85- 1065,9)</td>
<td>971,9 (397,6- 1244,6)</td>
<td>0,338</td>
</tr>
<tr>
<td>c</td>
<td>827,5 (641- 1170)</td>
<td>676 (279,5- 897)</td>
<td>862 (764- 962)</td>
<td>0,366</td>
</tr>
</tbody>
</table>

DISCUSSION

In the presenting study, our results showed that povidone-iodine has no incremental effect on peridural fibrosis which is an important etiological factor in the success of the spine surgery\(^{8,12,19,20,22}\).

Povidone-iodine is a widely used iodine-based topical antiseptic for cleaning the surgical site. It is extensively absorbed from mucosal surfaces. It is metabolised very little and excreted with urine without change. It is used in peritoneum, bladder, and spinal surgery for the aim of irrigation. Moreover, it is also used as an alternative option to talc in the pleurodesis to adhere the pleural layers\(^{7,15,23}\).

Povidone-iodine is frequently used in spine surgery with different aims. However, an important point is that the vessel-rich cancellous bone becomes apparent during laminectomy. Because of this reason, pressured irrigation fluid may escape into the intravascular space and may lead to symptoms hemodilution, electrolyte imbalance, and tissue and air emboli\(^9\).

The effects of povidone-iodine on wound healing effect and the activity of fibroblast cells is controversial. In a study evaluating the effects of 10% povidone-iodine’s concentration diluted into four forms (0.01%, 0.025%, 0.01%, and 1%) in vitro cell culture, it was found that povidone-iodine was toxic for mitotic cells, 0.01% and 0.025% forms inhibited the growth of fibroblasts, and 0.1% and 1% forms were toxic to fibroblasts. In a similar study it was reported that povidone-iodine was toxic for phagocytic cells and had an adverse effect on chemotaxis even at low dilutions. However, normal viability and function of monocytes was reported in 0.005% diluted form\(^{2,21}\).

However, in vivo and in vitro animal studies showed that diluted form of povidone-iodine had no effects on fibroblast and wound healing, tensile strength of wound, and re-epithelization in corneal and skin defects\(^1,3\). In another study, it was showed that povidone-iodine increased perfusion at the arteriolar and capillary levels. Authors suggested that this effect might be due to activity of plasmin in dilating blood vessels\(^{17}\). Plasmin breaks down the \(\alpha_2\)-gloublins which act cofactors in the synthesis of plasma kinines, which then induce vasodilatation. In the same study, authors reported that leucocyte activity was not changed 17). Rabeneberg et al reported relatively opposite results. They proposed that povidone-iodine had no effect at the level of arterioles and capillary and had no harmful effect on fibroblast cells at a 0.1 dilution\(^{18}\).
The safety of povidone-iodine in spinal surgery previously was studied by Chang et al. They aimed to observe the effects of povidone-iodine on fusion rate, improvement of pain score, function score, and ambulatory group. They concluded that there was no significant negative effect of diluted povidone-iodine irrigation on spinal fusion and clinical outcome. They proposed that povidone-iodine could increase the angiogenesis which is the essential in bone healing without altering microvessels(4). In our study, we found that povidone-iodine has no incremental effect on peridural fibrosis. So, it has no decreasing effect on success rate of spine surgery.

In conclusion, povidone-iodine may be used safely in spinal surgery when it is needed without increased risk of peridural fibrosis.

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