

Minimal effective dose of povidone-iodine in abdominal surgery

Our clinical experience



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The aim of this study is to evaluate the thyroid function tests in order to examine whether 10 % of Povidone-Iodine(PI), the medication we applied in 1/5 ratio diluted with 0.9 %NaCl, joins the systemic circulation during clean contaminated, contaminated and dirty operations for solid organ hydatid cysts in abdominal area to avoid abscess formation and spreading.

7 men and 6 women were included to the present study, prospectively. The mean age was 33.69(± 13.49). TSH, free T3 (fT3) and free T4 (fT4) hormone levels were measured before the operation and at the third day of postoperative period. Amount of used povidone-iodine for patients was recorded. As a result of statistical analysis applied, the preoperative and post operative values were not significantly different regarding with the measured hormone levels (preTSH vs postTSH: $p= 0.984$; prefT3 vs postfT3: $p= 0.101$; prefT4 vs postfT4: $p=0.146$). Thus, it has been shown that the dose we used is effective, and it does not enters at all or at quite low levels into the systemic circulation. Patients whom this application performed, abscess and intestinal adhesions have not been observed in our clinical experience. We recommend the use of suggested doses of Povidone-Iodine in the presence of intraabdominal perforation and abscess or in cases such as carrying a risk of cyst spreading to intraabdominal area in hydatid cysts.

KEY WORDS: Povidone-iodine, Surgical adhesions, Surgical wound infections, Thyroid function tests

Introduction

Thyroid hormones are synthesized from the follicular cells of the thyroid gland. In the synthesis of those hormones, inorganic iodine absorbed from the gastrointestinal tract or iodine obtained previously are used and eliminated later.

10 % of Povidone-Iodine(PI) solution contains 10 grams of Polyvinylpyrrolidone-Iodine and used as bactericidal,

fungicidal and virucidal ¹. This solution can be used in surgical operations, preoperative preparation of patients, and can be used anywhere that antiseptics is demanded. The aim of this study is to examine the influence of PI solution on the Thyroid Function Tests (TFT: TSH, FT3 and FT4), the antiseptic solution we used in localized intraabdominal irrigation subjected to limited areas with infection.

Materials and Methods

Thirteen consecutive patients were included to this prospective study, and admitted to the emergency department or outpatient clinic at our institution. Informed consent was obtained from all patients, and the study followed the ethical guidelines granted by the institutional ethical committee.

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Table I - Distribution of TFT in preoperative and postoperative period

Variables	Mean Values
Age	33.69±13.49(17-58)
Pre-TSH	2.37±1.28(0.76-5.13)
Pre-ft3	2.94±0.87(1.68-4.38)
Pre-ft4	1.23±0.22(1.03-1.7)
Post-TSH	2.36±1.74(0.20-6.91)
Post-ft3	2.71±0.71(1.74-4.02)
Post-ft4	1.35±0.20(1.02-1.72)

Table II - Statistically interrelation of TSH, T3 and T4 in preoperative and postoperative period ($p < 0.05$ is significant)

Interrelation	<i>p</i>
PreTSH vs PostTSH	0.984
Preft3 vs Postft3	0.101
Preft4 vs Postft4	0.146

The diagnosis of six of those patients were appendicitis (one perforated), two were sigmoid colon perforation dependent to a tumor, and one was necrotizing fasciitis due to rectal perforation, three were liver hydatid cysts and one was splenic hydatid cyst who all underwent cystectomy-cystostomy. Seven patients were male and six were female, and the mean age was 33.69 (± 13.49).

10 % of PI contains 1 % of iodine. In our clinic, 1/5 ratio of PI diluted with 0.9 % NaCl in a volume of approximately 350 (250-450) cc was poured on wherever a contamination existed including liver hydatid cysts, splenic hydatid cyst, clean-contaminated, contaminated and dirty surgeries followed by immediate irrigation with 1000cc of 0.9%NaCl. Then the whole abdomen was irrigated only with 0.9 % NaCl.

TFT values were studied preoperatively and at the postoperative 3rd day except routine blood counts in patients. Age, gender and the amount of PI solution used in the operation were recorded. Preoperative and postoperative routine eye examination was performed since visual loss due to iodine use has been reported in the literature ².

The patients' data were analyzed with SPSS 18 (SPSS Inc., Chicago, IL, US). Distribution patterns of the groups were analyzed using the one-sample Kolmogorov-Smirnov test. Parametric variables were compared using Paired Samples Test (Table I, II). Associations of variables were assessed by Pearson's correlation coefficient. Differences were considered significant for $p < 0.05$.

Table III - Interrelation between amount of PI solution and TFT ($p < 0.05$ is significant)

	PostTSH	Postft3	Postft4
<i>r</i> values	0.471	0.146	0.119
<i>p</i> values	0.104	0.633	0.698

Results

Based on the evaluation of the results, it appears that PI used at the indicated doses do not change the TFT. There is no evidence explaining the way that PI effects systemically in the dose we use. However, it prevents abscesses and wound infections in practice. It also doesn't cause intestinal adhesions in our clinical experience with the use of PI that we describe.

Pearson Correlation Test was performed to show the relationship between the postoperative TFT values and one ratio of PI and 4 ratio of 0.9 % NaCl that we used. There was no correlation between the amount of PI solution and TFT values (Table III).

Discussion

When we evaluate the results, there was no statistically significant change between blood TFT values we received before and after the operation. This suggests that PI doesn't affect the levels of TFT at this dose, or it is not absorbed enough to show its effect at the systemic level. Another possibility is that even if it is absorbed, no toxic effect is arisen at this dose. During the follow-up period of the patients, we did not encounter the development of any intra-abdominal abscess and wound infection suggesting that PI is non-toxic but effective at this doses.

Iodine is given orally for treatment. It is a well-known procedure that, about 10 days before a planned thyroid surgery, Lugol's solution is given orally to the patient in order to achieve euthyroid state ³. 5-7 drops orally (0.25-0.35 mL) is given three times a day ⁴. Daily dose of iodine in adults is 150µcg/day ⁵. Thyroid hormones are directly affected by the presence of iodine in the body. Highdoses of iodine can inhibit thyroid hormone secretion by changing the organic binding process (Wolf-Chaikoff effect), but this effect is temporary ⁶. It is stated that Lugol's solution decreases both thyroid hormones and blood supply to thyroid gland when used preoperatively in oral way for 10 days in Graves'disease. For that reason, some surgeons prefer the Lugol's solution in their practice from time to time; but its actual activity is still controversial ⁷.

PI has some toxic effects to the body including loss of vision. Wagenfeld L. et al. have reported loss of vision in a patient who underwent pleurodesis with PI ². In the

present study, routine eye examination was performed for all the patients but no abnormality was detected.

Gastrointestinal adhesions mainly caused by a cascade of injury-repair mechanism, and are dependent on fibrin accumulation between two damaged peritoneal surfaces. It can be avoided by improving surgical techniques, applying targeted pharmacologic interventions against inflammatory response and fibrin deposition, and using the physical barrier agents to avoid adhesion formation⁸. Use of PI is commonly referred to cause intestinal adhesions, but there is no sufficient data in this regard⁹. It has been continued to be irrigated with PI in decades from prevention of intra-abdominal abscess¹⁰. However, its doses used in general surgery practice could be considered quite speculative to be affirmative. For our clinical perspective, we think that it has been implemented in very high doses.

There are not enough studies on the absorption of PI from peritoneum. La VeHH et al., have asserted that PI leads to storage disease, kidney failure, sterile peritonitis and sclerosing serositis. In our clinical experience, we have never seen any of those side effects when provided at appropriate doses, and followed by enough irrigation by 0.9 %NaCl¹¹. On the other hand, no effect of PI on TFT may indicate its low absorption from the peritoneum. Therefore, at the given doses, PI may not cause described side effects.

In an experimental study, it is shown statistically that PI does not cause intestinal adhesions at certain doses¹².

Conclusion

We thought that the use of PI at lower doses is appropriate for irrigation in intra-abdominal infections or in the cases with high contamination risk, if it is provided properly in a way that the region is to be localized well and irrigated afterwards with 1000cc of 0.9 % NaCl. Because of no alteration in TFT values, its absorption from the peritoneum is suggested to be minimal, and it enters into the systemic circulation minimally. We also believe that further studies with higher number of study participants are required in this regard.

Riassunto

Scopo di questo studio è quello di valutare i test di funzione tiroidea per indagare se una soluzione di Povidone-Iodine (PI) al 10%, che usiamo nella diluizione 1/5 con 0,9% NaCl in area addominale durante interventi puliti-contaminati, contaminati e sporchi in caso di idatidiosi in organi parenchimatosi, al fine di evitare la formazione di ascessi e la disseminazione, raggiunge la circolazione sistemica.

In questo studio sono stati inclusi 7 uomini e 6 donne in maniera prospettica. L'età media era di 33,69

(\pm 13.49). Preoperatoriamente ed al terzo giorno post-operatorio sono stati dosati i livelli ormonali di TSH, T3 libero (FT3) e T4 libero (FT4). È stata presa nota della quantità di PI usata per ogni paziente.

Dall'analisi statistica non sono risultati valori significativamente differenti tra il preoperatorio ed il postoperatorio relativamente al livello degli ormoni tiroidei (preTSH vs postTSH: $p=0.984$; preFT3 vs postFT3: $p=0.101$; preFT4 vs postFT4: $p=0.146$).

Così si è dimostrato che la dose di PI usata è efficace e non entra, o quanto meno a livello piuttosto basso, nella circolazione sistemica. I pazienti in cui tale procedura è stata usata non sono andati incontro in questa nostra esperienza ad ascessi addominali o aderenze intestinali.

Raccomnadiamo dunque l'uso di queste dosi suggerite di PI in caso di perforazioni intestinali o ascessi, o in caso di possibile rischio di disseminazione in area intra-addominale di cisti idatidiche.

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