36 °C ısıtılmış %10'luk povidon-iyot solüsyonunun sezaryen operasyonlarında hastanın hemodinamiği üzerine etkisi

Effect of 36 °C heated 10% povidone-iodine solutions on patient's hemodynamics in caeserean operations

Vildan Kılıç[1], Mehmet Yılmaz[2] , Ayşe Zeynep Turan[2], Ünal Türkay[3], Aslı Duygu Aydaş[2], Tahsin Şimşek[2], Ahmet Kale[3], İpek Yakın Düzyol[2], Emine Yurt[2], Hasan Terzi[3]

1Uludağ Üniversitesi, Algoloji Kliniği, Bursa, Türkiye
2Sağlık Bilimleri Üniversitesi, Derince Eğitim Ve Araştırma Hastanesi, Anesteziyoloji Ve Reanimasyon Kliniği, Kocaeli, Türkiye
3 Sağlık Bilimleri Üniversitesi, Derince Eğitim Ve Araştırma Hastanesi, Kadın Doğum Kliniği Kliniği, Kocaeli, Türkiye

ÖZ

GİRİŞ ve AMAÇ: *Iodophor solusyonları cerrahi müdahale öncesi cilt antisepsisi için yaygın olarak kullanılmaktadır. Enyaygın kullanılan iodophor solusyonu %10 povidone–iodine'dir (PVI). Sezaryen operasyonlarında cerrahi-alan antisepsisinin anestezi indüksiyonundan önce yapılması genel anestezi uygulamasıdır. Bu sayede yenidoğan, daha az anestetik ajana maruz kalmaktadır.Bu çalışmada, genel anestezi altında sezaryen operasyonu uygulanan hastalarda farklı sıcaklıklarda PVI solusyonunun kullanılmasının hastanın hemodinamisi üzerine etkisini karşılaştırmayı amaçladık.*

YÖNTEM ve GEREÇLER: *Çalışmaya 178 genel anestezi altında opere edilen sezeryan hastası dahil edildi. Oda ısısındaki PVI kullanılan hastalar 'Soğuk PVI' grubu (n=93) olarak, EmTherm 3DS(EM- MED) ile 36 °C ısıtılan PVI kullanılan hastalar 'Sıcak PVI' grubu (n=85) olarak adlandırıldı.*

BULGULAR: *Grubların SKB değerleri karşılaştırıldığında bazal, indüksiyon, entübasyon, 5. dakika, 10. dakika ölçüm değerleri arasında istatistiksel olarak benzerlik bulundu (p>0.05). Ancak PVI ile boyama sonrası SKB değeri Soğuk PVI grubunda istatistiksel olarak anlamlı yüksek bulundu (p=0.040). Ayrıca operasyon başlangıç ve bitiş vucut ısıları, oda ısıları karşılaştırıldığında istatistiksel olarak anlamlı fark saptanmadı (p>0,05).*

TARTIŞMA ve SONUÇ: *Sezeryan operasyonlarında oda ısısında bekletilen (Soğuk) PVI kullanımının hasta hemodinamisi üzerinde etkisinin bulunduğunu ancak anestezi indüksiyonu ile bu etkinin baskılandığını düşünüyoruz. Bu nedenle hemodinamik olarak instabil hastalarla, hipertansiyon, diabet, koroner kalp hastalığı, kalp yetmezliği gibi ek komorbiditesi olan hastalarda PVI'un 36 °C'e ısıtılmasının yararlı olabileceği kanaatindeyiz.*

Anahtar Kelimeler: *%10 povidone–iodine, sezaryen operasyonu, genel anestezi, hemodinamik değişiklikler*

ABSTRACT

INTRODUCTION: *Iodophore solutions are widely used as skin antiseptics prior to surgery. The most frequently used iodophore solution is 10% povidone- iodine(PVI). Performing surgical-field antisepsis before the induction of anaesthesia in caesarean section operations is a general anaesthetic practice. In this way, the newborn will be exposed to less of the anaesthetic agent. In this study we aimed to compare PVI solution at specified temperatures on heamodynamic changes of the patients who undergo ceserian section under general anesthesia.*

METHODS: *178 patients who underwent elective caesarean section under general anaesthesia were included. The group of patients who received PVI at operating room temperatures was named the "Cold PVI" group (n = 93), and the group of patients who received PVI heated to 36°C was named the"Warm PVI" group (n = 85). The heating of PVI was done using EmTherm3DS(EM-MED)heater.*

RESULTS: *Statistically significant similarities were found when the basal, induction, intubation and 5th and 10th minute post-intubation SAP levels between the groups (p>0.05). However, the SAP levels following surgical staining with PVI were found statistically significantly higher in the "Cold PVI" group (p=0.040). At the beginning and ending of the operation body temperatures and room temperatures were similar between the groups.*

DISCUSSION AND CONCLUSION: *PVI kept at room temperature (Cold PVI) before use in caesarean section operations does seem to affect the patient haemodynamics, but this effect is suppressed by anaesthetic induction. Therefore, we suggest that PVI heated up to 36°C may be beneficial in haemodynamically unstable patients and patients who have comorbidities, such as hypertension, diabetes, coronary arterial disease and heart failure.*

Keywords: *10% povidone-iodine, cesarean operation, general anesthesia, hemodynamic changes*

İletişim / Correspondence:

Mehmet Yılmaz
Sağlık Bilimleri Üniversitesi, Derince Eğitim Ve Araştırma Hastanesi, Anesteziyoloji Ve Reanimasyon Kliniği, Kocaeli, Türkiye
E-mail: drmyilmaz33@mynet.com
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INTRODUCTION

Iodophore solutions are widely used as skin antiseptics prior to surgery.1 The most frequently used iodophore solution is 10% povidone-iodine (PVI).2,3 PVI is usually preserved and used at operating room conditions, meaning it is generally applied at a temperature of 20–24°C. Several publications indicated that heating these PVI solutions to 40 °C enhances patient comfort and does not reduce the antiseptic properties.4-6

The rapid induction of anaesthesia is recommended so that newbornsare less affected by the anaesthesia during caesarean operations.7 In addition, performing surgical-field antisepsis before the induction of anaesthesia in caesarean section operations is a general anaesthetic practice. In this way, the newborn will be exposed to less of the anaesthetic agent. However, we hypothesized that the temperature of the PVI solution used in this case may cause hemodynamic changes by stimulating the patient's sympathoadrenal system, because temperature considered as one of the stress factors in the literature. The autonomic sympathetic system, which is stimulated by stress factors such as temperature, causes catecholamine secretions from the adrenal medulla. For this reason, we compared the use of PVI at two different temperatures for surgical field antisepsis before anaesthesia induction in caesarean operations; the hypothesis was that catecholamine may be secreted at different levels at the two different temperatures and thus cause different hemodynamic responses at.8-12

MATERIALS AND METHOD

Following approval of the local ethics committee, 1,321 patients operated on in the same operating room of the Obstetrics and Gynecology Department of our university hospital between July 2016 and July 2017 were evaluated. Among these, 846 patients preferred regional anaesthesia, and 297 patients underwent urgent surgery and were excluded from the study. Obtaining informed consent, 178 patients received an elective caesarean section under general anaesthesia and were randomized into two groups using the closed-envelope method.

The group of patients who received PVI at operating room temperatures was named the"Cold PVI" group (n = 93), and the group of patients who received PVI heated to 36°C was named the"Warm PVI" group (n = 85; **Figure 1).** The heating of PVI was done using EmTherm 3DS(EM-MED) heater.

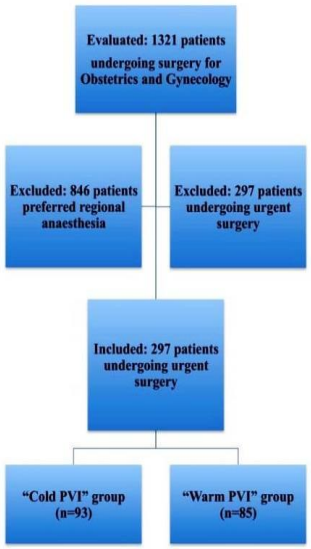

Figure 1. Flowchart

Premedication was not performed prior to the operations. The patients were monitored in terms of standard electrocardiography (ECG), peripheral oxygen saturation (SpO2), non-invasive blood pressure and body temperature. Following a load of 500 ml of a 0.9% NaCl solution, a continuous infusion at a rate of 10 ml/kg/h was started through a 20 G intravenous cannula inserted on the left hand.

After eight times ventilating the vital capacity of their lungs in the first minute by 100% oxygen, the patients were given propofol (2–2.5 mg/kg) and rocuronium bromide (0.6–1 mg/kg) for anaesthetic induction, and tracheal intubation was performed with a number 6.5–7.0 endotracheal tube (ETT). The anaesthetic was maintained using 1 minimum alveolar concentration (MAC) of sevoflurane and nitrous oxide in 50–100% oxygen until birth, with 0.5–0.75 MAC sevoflurane, 1 MAC nitrous oxide and opioids following the birth and 1 mg midazolam to prevent awareness.

The heart rate (HR), SpO2, systolic arterial pressure (SAP), diastolic arterial pressure (DAP) and mean arterial pressure (MAP) were measured by non-invasive methods once the patients entered the operating room, and these were recorded as basal values. These values were again measured and recorded following surgical cleansing, anaesthetic induction, orotracheal intubation with laryngoscopy, and on the 5th and 10th minutes of intubation. Likewise, the operating room temperatures were recorded at the beginning and at the end of the operations. Surgical site infections that occurred in the first 30 days post-operation were recorded.

RESULTS

One hundred and seventy-eight patients aged between 18 and 42 years were enrolled in the study. There were no significant differences between the groups in terms of age, body weight, height and rates of wound infection. There was also no statistically significant difference between groups when the body temperatures of the patients and operating room temperatures at the start and end of the operations were compared (p>0.05; **Table 1).**

Table 1. Demographic data of the groups

	Cold PVI (n=93)	Warm PVI (n=85)	P
Age (Year)	28.49±5.71	29.2±5.32	0.396*
Weight (kg)	79.24±11.27	79.71±11.25	0.930**
Height (cm)	162.10±5.32	162.25±5.45	0.942**
Body temperature begining of operation	36.58±0.39	36.54±0.28	0.385**
Body temperature end of operation	36.29±0.41	36.33±0.33	0.670**
Room temperature beginning of operation	20.61±1.10	20.36±1.27	0.068**
Room temperature end of operation	20.70±1.06	20.44±1.26	0.051**
Wound site enfection	0.03±0.17	0.02±0.15	0.726**

Statistically significant similarities were found when the basal, induction, intubation and 5th and 10th minute post-intubation SAP levels were compared between the groups (p>0.05).

However, the SAP levels following surgical staining with PVI werefound to be statistically significantly higher in the "Cold PVI" group (p=0.040; **Table 2).**

Table 2. SAP data of groups

	Cold PVI (n=93)	WarmPVI (n=85)	p
Basal SAP	127.25±14.34	124.49±11.94	0.364*
Surgical cleansing SAP	130.50±12.82	126.67±11.78	0.040**
Induction SAP	116.03±21.66	117.56±14.18	0.446*
Intubation SAP	139.50±23.50	142.50±22.06	0.382**
5. minute SAP	125.95±19.34	123.12±16.38	0.459*
10. minute SAP	117.67±14.01	116.29±15.30	0.349*

*Independent Samples T test: values are given as mean ± standard deviation
**Mann Whitney U test: values are given as mean ± standard deviation

All values measured for the comparison of the DAP and MAP levels between the groups were found to be statistically similar (p>0.05; **Table 3** and **Table 4**, respectively), and the same was true for the comparison of the HR and SpO2 levels between the groups (p>0.05; **Table 5 and Table 6**, respectively).

Table 3. DAP data of groups

	Cold PVI (n=93)	Warm PVI (n=85)	p
Basal DAP	74.92±10.56	73.84±9.58	0.478*
Surgical Cleansing DAP	76.19±11.45	74.97±8.65	0.423*
Induction DAP	67.35±13.06	68.38±11.65	0.466**
Intubation DAP	85.54±17.93	86.11±17.61	0.746**
5. minute DAP	68.78±13.14	65.80±11.30	0.134**
10. minute DAP	63.02±8.84	61.62±9.81	0.187**

* İndependent Samples T test: values are given as mean ± standard deviation. **Mann Whitney U test: values are given as mean ± standard deviation

Table 4. MAP data of groups

	Cold PVI (n=93)	Warm PVI (n=85)	
Basal MAP	94.90±11.05	93.22±9.63	0.283*
Surgical cleansing MAP	97.10±11.21	94.40±8.29	0.067*
Induction MAP	86.27±14.88	88.24±15.17	0.376**
Intubation MAP	105.09±18.73	106.81±19.13	0.547*
5. minute MAP	91.26±14.47	87.96±11.29	0.136**
10. minute MAP	84.75±12.75	83.35±10.77	0.311**

*İndependent Samples T test: values are given as mean ± standard deviation. **Mann Whitney U test: values are given as mean ± standard deviation

Table 5. HR Data Of Groups

	Cold PVI (n=93)	Warm PVI (n=85)	
Basal HR	95.82±14.88	92.56±14.37	0.139*
Surgical cleansing HR	96.89±13.63	96.03±14.87	0.689*
Induction HR	105.40±17.79	102.09±17.67	0.362**
Intubation HR	117.67±16.79	118.04±15.64	0.880*
5. minute HR	96.96±16.79	99.84±14.60	0.227*
10. minute HR	88.93±14.95	90.40±12.77	0.486*

*Independent Samples T test: values are given as mean ± standard deviation **Mann Whitney U test: values are given as mean ± standard deviation

Table 6. SPO2 Data of Groups

	Cold PVI (n=93)	Warm PVI (n=85)	p
Basal SPO2	98.76±1.03	98.63±1.35	*0.677
Surgical Cleansing SPO2	99.17±0.90	99.22±0.87	*0.752
Induction SPO2	99.54±0.68	99.56±0.68	*0.971
Intubation SPO2	99.35±0.96	99.31±1.02	*0.949
5. minute SPO2	99.19±0.97	99.05±0.90	*0.160
10. minute SPO2	99.03±1.03	98.95±0.96	*0.410

*Mann Whitney U test: values are given as mean ± standard deviation

The changes in both of the groups were similar in terms of the evaluation of the intra-group haemodynamic parameters. Statistically significant similarities were found between the basal levels and the levels following the surgical staining in terms of the SAP (Figure 2), DAP (Figure 3), MAP (Figure 4) and HR (Figure 5). Statistically significant differences were found forthe other measurements.

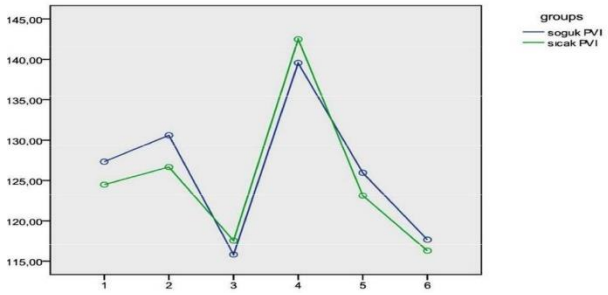

Figure 2. SAP data of groups

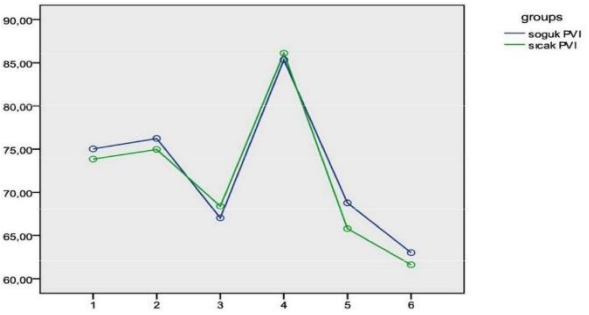

Figure 3. DAP data of groups

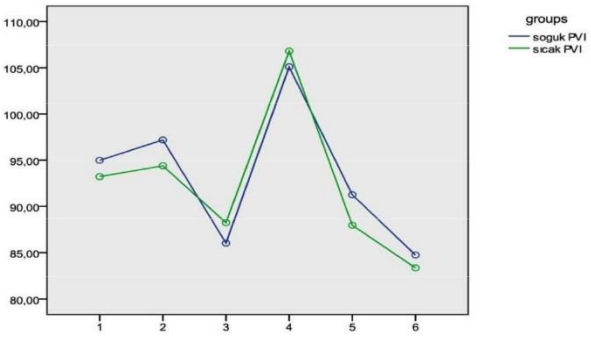

Figure 4. MAP data of groups

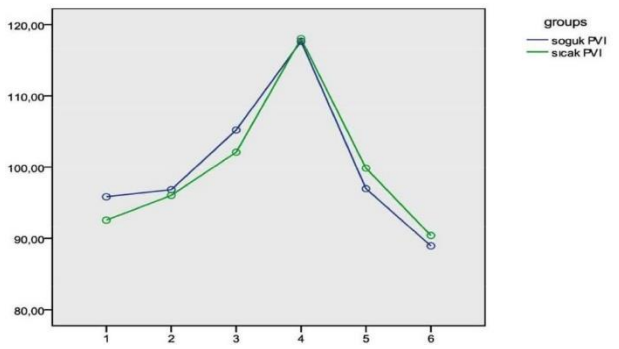

Figure 5. HR data of groups

DISCUSSION

Laryngoscopy and tracheal intubation may cause a hemodynamic responsesuch as tachycardia and hypertension.This hemodynamic change cancause serious vital complications.13-15 There are clinical trials showing that the activation of the autonomic sympathetic system causes catecholamine secretions, and these catecholamines play a role in the formation of this hemodynamic response.16,17 Similarly, the surgical procedure itself can initiate the stress response of the hypothalamic-pituitary-adrenal axis. In addition to the stimulation of cytokine production, neural stimulation from the surgical site plays a role in the development of the stress response during surgery.18 For this reason, we believe that surgical field antisepsis before anaesthesia induction could lead to the stress response. Deeper anaesthesia, opioids and vasodilators can prevent this sympathoadrenal response, and alpha and beta adrenergic blockers are widely used to prevent the hemodynamic response to laryngoscopy and endotracheal intubation.19-22 However, the use of drugs such as opioids and other alternatives in special groups of patients, such as pregnant women, are limited because of transplacental drug transfer, which can cause undesirable effects for the baby.23,24

The haemodynamic response caused by laryngoscopy and endotracheal intubation is still a problem for pregnant patients. We hypothesized that using askin antiseptic before anaesthesia induction, in order to reduce the anaesthetic exposure for the newborn, could increase the haemodynamic response to laryngoscopy and endotracheal intubation.

Temperature has also been considered as one of the stress factors in the literature. The autonomic sympathetic system that is induced by stress causes the discharge of catecholamines from the adrenal medulla.8-12 Therefore, we hypothesized that the use of PVI at two different temperatures for caesarean section operations in which the surgical site cleaning was applied before anaesthetic induction couldresult in different levels of catecholamine discharge and different levels of a haemodynamic response. In our study, the SAP levels were found to be statistically significantly higher in the “Cold PVI” group following the surgical cleansing with PVI ($p=0.040$), although the base SAP levels were statistically similar between the two groups ($p>0.05$; Table 2). We supposed that PVI heated to a normal body temperature (36°C) wouldnot induce the autonomous sympathetic system, but PVI kept at room temperature (Cold PVI) induced the autonomous sympathetic system, resulting in catecholamine discharge.

Increased patient comfort with the use of PVI heated to 40°C was mentioned in the literature. It was also mentioned in these studies that no decrease in the antibacterial effect of PVI occurred through heating.4-6 This is likely true, since the surgical site infection rates were found to be statistically similar among the groups in our study ($p=0.726$;Table 1). We interpreted this to mean that heating the PVI to 36°C had no effect on the post-operative wound site infection rate.

Instead of serum catecholamine levels, haemodynamic changes were used as the evaluation method for the effects of PVI at different temperatures, which forms the major limitation of our study.

In conclusion, it seems that PVI heated to 36°C does not affect the body temperature or the incidence rates for postoperative surgical site infections. Moreover, PVI kept at room temperature (Cold PVI) before use in caesarean section operations does seem to affect the patient haemodynamics, but this effect is suppressed by anaesthetic induction. Therefore, we suggest that PVI heated up to 36°C may be beneficial in haemodynamically unstable patients and patients who have comorbidities, such as hypertension, diabetes, coronary arterial disease and heart failure.

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