AÇIK KALB AMELİYATLARINDA FARKLI KOMPOZİSYONLARDAKİ PRİME SOLUSYONLARIN GÖZ İÇİ BASINCINA ETKİLERİ

THE EFFECTS OF PRIME SOLUTIONS WITH DIFFERENT COMPOSITIONS ON INTRAOCULAR PRESSURE DURING OPEN HEART SURGERY.

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Özet

Açık kalb ameliyatlarında ekstra korporal dolaşım esnasında farklı kompozisyonlardaki prime solusyonların göz içi basıncına etkisini araştırmak için 19 vakalık birinci gruba Ringer laktat, 12 vakalık 2. gruba Haemaccel, 7 vakalık 3. gruba da human albumin kullanıldı. Göz içi basınçları ekstra korporal dolaşım öncesi, esnası ve sonrasında ölçüldü. Ayrıca operasyon esnasında arteriyel kan basınçları, hemotokrit, kan gazları ve pH gibi parametreler izlendi. Ringer laktat kullanan gurupta ekstra korporal dolaşımın ilk 5 dakikasında göz içi basıncında yaklaşık 8 mmHg değerinde yükselme oldu ($p<0.001$). Göz içi basıncı yaklşık 30 dakikada normal seviyelere döndü. Haemaccel ve human albumin kullanan guruplarda ekstra korporal dolaşım esnasında göz içi basıncında anlamlı değişiklik olmadı. Varians analizi ile yapılan istatistiksel değerlendirmede Ringer laktat ile Haemaccel ve Human albumin'in göz içi basıncı üzerine etkileri arasında anlamlı farklar bulundu. Ekstra korporal dolaşımın başlaması ile tansiyon arteriel ve hematokrit değerlerinde düşüşler tespit edildi. Diğer parametrelerde önemli değişiklikler olmadı. Göz içi basıncı, venöz basınç, arteriyel kan basıncı ve intra kranial basnç arasında korelasyon vardır. Göz içi basıncındaki yükselmeler sistemik interstisiel ödemin de göstergesidir. Sonuç olarak açık kalb ameliyatlarında ekstra korporal dolaşım esnasında gerek oküler gerekse sistemik komplikasyonların önlenebilmesi için, göz içi basıncını stabil halde tutabilen osmotik yönden aktif prime solusyonların kullanılmasının gerekliliğine inanıyoruz.

Anahtar kelimeler: *Açık Kalp Cerrahisi, Prime Solusyonu, Göz İçi Basıncı*

Summary

In the this study, the effects of prime solutions with different compositions on intraocular pressure (IOP) were investigated during the period of extracorporeal circulation (ECC). Intraocular pressure was accepted as an indicator of intersititel compartment pressure. Ringer lactate, Haemaccel, and Human Albumin were applied to 19, 12 and 7 patients, respectively. Intraocular pressures were measured before, during and after the period of extracarporeal circulation. Intraocular pressures of the patients who were administered Ringer lactate solution increased significantly, approximately 8 mmHg, during the first 5 minutes, and returned to normal levels within 30 minutes. No statistically significant changes were observed in the intraocular pressures of both Haemaccel and Human albumin groups. Variance analysis showed that there was a statistically significant difference between Ringer lactate group and the other two groups in terms of IOP values ($p< 0.05$). Human albumin and Haemaccel which are osmotically active and plasma volume expanders did not change the IOP level during the period of ECC ($p>0.05$), and that Ringer Lactate caused a transient, important increase in IOP values ($p< 0.05$). As a conclusion, we believe that the composition of prime solution is very important and that osmotically active component should be added to prime solutions so as to prevent both ocular and systemic complications.

Key words: *Open Heart Surgery, Prime Solution, Inraocular pressure*

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Introduction

It is clearly known that alterations in blood pressure, extracellular fluid composition including blood, and osmolality may affect the fluid content of the tissues (1). A number of important changes, such as systemic hypotension, decrease in arterial perfusion pressure, hemodilution, hypothermia and decreased colloidal osmotic pressure, are observed during the

Table I. *Intraocular Pressures of the Groups and Statistical Results (Paired student's t test)*

	Before ECC	5th min of ECC	15th min of ECC	30th min of ECC	45th min of ECC	After ECC
Ringer lactate group	12.62±0.41 (10.6-17.3)	*20.30±0.76 (11.2-31.8)	*15.64±0.70 (10.2-22.2)	**14.20±1.02 (10.2-27.2)	11.01±0.96 (6.3-22.2)	11.60±0.63 (6.8-14.6)
Heamaccell group	14.49±0.67 (11.2-18.4)	14.88±1.25 (8-18.4)	12.72± 1.16 (7.5-18.4)	15.27±16.7 (7-19.6)	15.36±1.58 (7-18.4)	16.29± 1.04 (10.2-17.3)
Human albumin group	14.64±0.53 (12.2-17.3)	14.65±1.00 (12.2-17.3)	13.14±0.92 (10.2-14.6)	15.04±1.33 (10.2-19.6)	15.50±1.26 (10.2-20.4)	14.87±0.83 (13.4-23.7)

All units are mmHg. Values are given as mean± standard error,values in parentheses show minimum and maximum levels. * : $p < 0.001$, ** : $p < 0.05$ when compared with preECC levels.

period of extracorporeal circulation (ECC) and consequently, the intraocular pressure (IOP) may be affected by these changes (2). The change of IOP denotes the changes that may occur in other parts of the body (3). Different results have been published regarding the changes observed in IOP values during the period of ECC. Some investigators such as Larkin et al, Stellpflug et al and Deutch et al reported increased IOP levels during ECC(2,4,5). In contrast, Lilleaasen and Hfrven et al found that IOP did not vary significantly from precardiopulmonary bypass values (3,6). The purpose of this study is to investigate the effects of prime solutions with different compositions on IOP.

Materials and Methods

Thirty-seven patients, 16 males and 21 females, were included in this study. Their age range was 11 to 65 years, and the mean age was 38 years. Before open heart operation the eyes of all patients were examined by an ophthalmologist and none had any ocular disease. General anesthesia was induced with Fentanyl, Vecuronium Bromide, Dihidrobenzperidol, Na thiopental, and 50% Nitrous oxide in Oxygen. The patients were divided into three groups consisting of 19 (Ringer lactate group) 11 (Haemaccel group), and 7 (Human albumin) patients. The prime solution composed of Ringer Lactate 2000 cc, $NaHCO_3$ 40cc, and mannitol (20%) 2.5cc/kg in the first group, and of Ringer Lactate 1500 cc, Haemaccel 500 cc, $NaHCO_3$ 40cc, and mannitol (20%) 2.5cc/kg in the second group, and of Ringer lactate 2000 cc, Human albumin (20%) 100cc, $NaHCO_3$ 40cc, and mannitol (20%) 2.5cc/kg in the third group. During the period of ECC, body temparature was kept between 28- 32 ^{o} C and circulation rate was reduced to 2.2 l/min/m^2, arterial blood pressure to 60-70 mmHg, and hematocrit to 20-25 per cent. IOP of the patients were measured just before (at the 5 th,15 th, 30 th,and 45 th minutes) and after the period of ECC by a Schiotz tonometer. The measurements were analysed by paired t test and variance analysis. All statistical data related to measurements, such as mean, standard deviations, ranges and p values, are presented in Table I. The results of variance analysis are shown in Table II. As can be seen from Table I, IOP measurements increased at a statistically significant level ($p < 0.01$) within the first 5 minutes, and then gradually decreased to the previous levels after 30 minutes in the Ringer Lactate group. Any significant change in IOP values during and after ECC period was not detected in the Haemeccell and Human albumin ($p > 0.05$). According to the results of variance analysis (Table II) it could be said that there were statistically significant differences between the IOP of the groups who were applied the prime solutions with different compositions. (Fig.I).

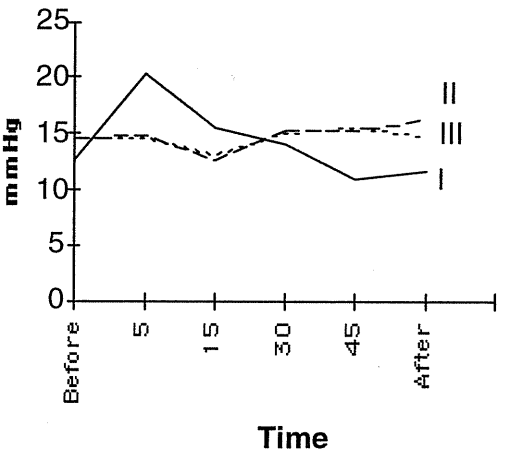

Fig I. *Intraocular pressure changes of the three groups throughout ECC period*
I : Ringer lactate group
II: Heamaccell group
III: Human albumin group

Discussion

It is known that of patients undergoing cardiac surgery with cardiopulmonary bypass may develop ocular complicatons (7). These changes have been attributed to the variety of physiologic changes

Table II. Results of Variance Analysis

	Before ECC	5 th min of ECC	15th min of ECC	30th min of ECC	45th min of ECC	After ECC
F	5.58	12.76	3.51	0.20	5.09	9.24
P	0.008_{xx}	0.001_{xx}	0.04_{x}	0.81-	0.01_{xx}	0.001_{xx}

xx: P< 0.01 x: P<0.05,

occurring during cardiac operation (5). It has been known that general anasthesia causes a decrease in IOP of the patients (8), but there are controversial views about the effect of prime solution on IOP used in open heart surgery. Larkin et al (2) used Hartman's solution as a prime solution in their study and found rapid rise in IOP levels at the begining of ECC and this was maintained 30 minutes. Similarly, Sansoy et al (9) used 2000 ml of 0.9 % Nacl as a prime solution and detected that IOP levels increased during the first 5 minutes and returned to normal levels after about 30 minutes. In addition, Baybek et al (10) used different solutions during their study but they did not evaluate the effects of the solutions separately, although they found similar results. In Ringer lactate group, we also found that IOP increased significantly within the first 5 minutes of ECC and then remained 30 minutes that was in consistent with the earlier studies (2,4). Lilleaasen et al used 1900 cc Ringer's lactate + 100 cc 25 % glucose + 200 cc albumin , and Hfrven et al used 1080 cc Ringer's acetate +120 cc 25 % glucose +120 cc albumin and both of the investigators did not find any significant change in IOP during ECC(2,5). In our study, we also could not show any difference in IOP values between pre ECC and during ECC values in Haemaccel and Human albumin groups.

The solutions that we used were similar to those of Lilleaasen et al and Hfrven et al(2,5). During the period of ECC, a number of factors, such as hypothermia (10), hypotension (2,11) hemodilution (12), hyperosmolality (6,10) nonpulsatile perfusion (8) and mannitol (11), have important effects on the regulation of IOP. For this reason, it has been thought that IOP was affected by many factors. There is a close correlation between IOP and arteriel blood pressure, venouse pressure, and intracranial pressure(6).

The increase at IOP is also an indicator of the systemic interstitial edema. Sansoy and co-workers (9) and Bavbek and co-workers (10) have stated that the increase in IOP occured due to hemodilution, but Larkin et al (2) have reported that hemodilution had a partial effect on IOP. Hfrven and associates have noticed that the composition of prime solution and hemodilution procedures were the factors affecting IOP changes.

Lilleaasen and co-workers (3) recommends the prime solution to be hypertonic. It has been observed from this study that Human albumin and Haemaccel which are osmotically active and plasma volume expanders did not change the IOP level during the period of ECC, and that Ringer Lactate caused a transient, important increase in IOP values.

As a conclusion, we believe that the composition of prime solution is very important and that osmotically active component should be added to prime solutions so as to prevent both ocular and systemic complications.

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