

# Intraoperative Glycaemic Control in Non Insulin Dependent Diabetes Mellitus: A Comparison between Normal Saline and Ringer's Lactate

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## ABSTRAK

Kajian ke atas 50 pesakit *Non-Insulin Dependent Diabetes Mellitus* (NIDDM) yang menjalani pembedahan di bawah anestesia (pelalian) epidural telah dijalankan. Kesemua pesakit diberi infusi dekstros 5% 100ml/jam dari masa berpuasa hingga pesakit tiba di bilik bedah. Pesakit dibahagikan kepada dua kumpulan secara rawak. Pesakit dalam Kumpulan 1 (n=25) menerima salin normal manakala pesakit Kumpulan 2 (n=25) diberi laktat Ringer. Kedua-dua kumpulan menerima infusi sepanjang masa pembedahan sehingga empat jam selepas pembedahan. Aras glukos darah diambil tiga kali, iaitu semasa permulaan (baseline), 45 minit semasa pembedahan sedang berjalan, 30 minit dan empat jam selepas pembedahan menggunakan glukometer. Hasil kajian menunjukkan paras glukos darah min 1.5 mmol/L lebih tinggi pada pesakit Kumpulan 2 di antara empat jam selepas pembedahan dan permulaan, (baseline) berbanding dengan 0.96 mmol/L di kalangan pesakit Kumpulan 1. Walau bagaimanapun, statistik menunjukkan keputusan ini adalah tidak signifikan. Tidak terdapat perbezaan paras glukos min pada 30 minit bila dibezakan dengan permulaan (baseline). Paras glukos darah min menunjukkan kenaikan yang signifikan pada kedua-dua kumpulan selepas pembedahan apabila dibezakan dengan paras glukos di waktu permulaan. Hasil kajian ini menunjukkan bahawa pesakit NIDDM yang menerima laktat Ringer mempunyai kenaikan paras glukos darah min yang lebih besar apabila dibezakan dengan pesakit yang menerima salin normal, akan tetapi, magnitudnya tidak signifikan dari segi statistik.

*Kata kunci:* kawalan glisemik intraoperatif, diabetes melitus, laktat Ringer, salin normal.

## ABSTRACT

Fifty Non Insulin Dependent Diabetes Mellitus (NIDDM) patients undergoing surgery under epidural anaesthesia were studied. All patients received dextrose 5% infusion at 100 ml/hr from the period of fasting until upon arrival to the operation room. Patients were randomly divided into two groups. Patients in Group 1 (n=25) received normal saline while patients in Group 2 (n=25) were given Ringer's lactate. Both groups received their infusion throughout the operative period up to four hours postoperatively. Blood glucose level was measured at baseline, 45 minutes intra operatively and postoperatively at 30 minutes and four hours by using a glucometer. Patients in Group 2 has a larger mean increase in blood glucose level of 1.5 mmol/L between 4 hours postoperatively and baseline compared to 0.96 mmol/L in

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Group 1. However, this was not statistically significant. There was no difference in the increase of mean glucose level at 30 minutes when compared to baseline. There was a significant increase in mean blood glucose level in both groups in the postoperative period when compared to baseline. This study demonstrated that patients with NIDDM receiving Ringer's lactate has a larger increase in mean blood glucose level compared to those receiving normal saline, but the magnitude is not statistically significant.

**Key words:** Intraoperative glycaemic control, diabetes mellitus, Ringer's lactate, normal saline

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## INTRODUCTION

Lactate is a gluconeogenic precursor that is rapidly metabolized, particularly during starvation or when there is increase in body catabolism. A study done by Thomas and Alberti showed that in Non Insulin Dependant Diabetes Mellitus (NIDDM) patients who were given Ringer's lactate in amount of 29-44 mmol during surgery had an increased in mean plasma glucose of 7.5 mmol/l when compared to those not given intravenous fluids amounting only 2.1 mmol/l (Thomas and Alberti 1978). Therefore, higher insulin doses may be required for diabetic patients receiving Ringer's lactate during the peri-operative period. In another study, it was shown that the infusion of Ringer's lactate at a rate of 25  $\mu$ mol/kg/min over three hours in non diabetic patients did not alter plasma glucose production (Jenssen et al. 1989). However, there is no study yet to compare the effect of giving normal saline to patients with NIDDM when compared to Ringer's lactate. With this interest in mind, a prospective randomized study was done to evaluate the effect of Ringer's lactate in comparison with normal saline on the glycaemic control in patients with NIDDM. The aim of this study was to compare the intraoperative glycaemic control in patients with NIDDM when given either normal saline or Ringer's lactate.

## MATERIALS AND METHODS

This was a prospective randomised controlled single blind study carried out in

Hospital Sultanah Aminah, Johor Bahru. After obtaining institutional approval and informed consent, 50 ASA II patients with NIDDM aged 21-70 years undergoing elective or emergency surgical procedures under spinal or lumbar epidural anaesthesia lasting more than one hour were included in the study. Exclusion criteria included patients who have impaired renal or liver function, allergy to the regime solution used and those patients where spinal or lumbar epidural were contraindicated.

All patients were assessed pre-operatively the day before and no premedication was served. An infusion of dextrose 5% at 100 mls/hr was administered once patients fasted until their arrival to the operation room. All oral hypoglycaemic agents were omitted on the day of operation. In the operation theatre, patients were randomized into two groups using a table of random sampling. Patients in Group 1 received normal saline and patients in Group 2 received Ringer's lactate. Both regimes were infused at 100 mls/hr using an infusion pump. Spinal or lumbar epidural anaesthesia was then performed under aseptic technique using a 27G Pencan<sup>®</sup> or 18G Tuohy needle. Throughout the operation, all patients were monitored with a pulse oximeter, electrocardiogram and a non invasive blood pressure monitoring device. All patients received supplemental oxygen at 6 l/min via a simple face mask.

Blood glucose levels were measured using a glucometer by the pinprick method. Levels were measured at baseline (before

performing spinal or epidural blockade), at 45 minutes intra operatively, at 30 minutes, and four hours postoperatively. Other parameters recorded include duration of anaesthesia, volume of regime fluids infused and rescue medication given if any.

Duration of anaesthesia is defined as the time interval from the onset of neural blockade till completion of surgery. Rescue action will be taken if the blood glucose level is below 2.2 mmol/l or more than 15.0 mmol/l, according to the British National Formulary 1997;

< 2.2 mmol/l	50 mls dextrose 50% to be given.
2.2-15.0 mmol/l	No action.
> 15.0 mmol/l	4ü insulin/hr and adjusted accordingly.

Hypotension is defined as a drop in 20% of systolic blood pressure from baseline and is treated with boluses of 5 ml/ kg of the infused fluids for the groups respectively. Boluses of ephedrine 6mg every 10 minutes will be given if hypotension persisted despite adequate boluses of fluids given. All patients were kept in the recovery room for the duration of the study.

Data was analysed using paired Student's t test and Chi- square test where appropriate. A 'p' value of < 0.05 was used as the level of statistical significance.

**RESULTS**

Demographic data and patient's variables are shown in Table 1. Both groups were comparable in terms of age, weight, sex, duration of anaesthesia and volume of intravenous fluids given.

The mean blood glucose levels for the two groups is shown in Table 2. There was an increase in blood glucose levels with time in both groups, except at 45 minutes intraoperatively in Group 1. There were significant differences in the mean blood glucose level between Group 1 and 2 except at baseline. The increase in the mean blood glucose level at 4 hours postoperatively when compared to baseline

is greater in Group 2 which was 1.50 mmol/L (19%) versus 0.96 mmol/L (13%) in Group 1. However, this difference was not significant (p>0.05). There was no difference in the increase of mean blood glucose levels in both groups in the intraoperative period when compared to baseline. Whereas, there was significant increase seen in the postoperative period.

Table 1: Demographic data, duration of anaesthesia, volume of fluids infused and type of cases. Values expressed as mean ± standard deviation (SD) and number (n) where appropriate.

	GROUP 1 (n=25)	GROUP 2 (n=25)
Age (years)	58.6 ± 8.0	58.1 ± 8.1
Male: Female	14:11	15:10
Weight (kg)	62.0 ± 8.7	62.0 ± 10.3
Mean duration of anaesthesia (mins)	83.4 ± 22.3	81.2 ± 20.2
Mean IV fluids infused ( litres )	1.26 ± 0.21	1.36 ± 0.35
Elective: Emergency cases	10 :15	6 : 19

Table 2: Mean blood glucose levels at different time of anaesthesia for two groups. Values expressed as mean ± SD, and number (n) where appropriate.

	Group 1 (n=25)	Group 2 (n=25)
Baseline (mmol/l)	7.06 ± 1.97	7.84 ± 2.34
Intraoperative (mmol/l) 45 minutes	7.05 ± 2.42*	7.89 ± 1.32*
Postoperative (mmol/l) 30 minutes	7.31 ± 2.43*	8.56 ± 0.49*
Postoperative (mmol/l) 4 hours	8.02 ± 2.48*	9.34 ± 0.49*

\* p < 0.05

## DISCUSSION

Diabetes mellitus is the commonest endocrine disorder encountered in anaesthesia and its incidence is increasing (Milaskiewicz and Hall 1992, Scherpereel and Tavernier 2001). Ninety percent of diabetic patients are NIDDM and this is attributed to the sedentary lifestyle, genetic predisposition and diet. It is expected that the number of people in the world with diabetes will double in the next decade (Hall et al. 1999). Due to advances in medical and surgical therapy, it is likely that diabetic individuals have a greater chance of undergoing surgery today such as vitrectomy, cataract extraction and ulcer debridement with good outcome (Hirsch et al. 1991).

In this study, we are looking specifically on the type of solutions in perioperative glycaemic control. Hartmann's solution is used interchangeably as Ringer's lactate in daily use. It is often regarded as the anaesthetic panacea of fluid resuscitation. This crystalloid formulation is routinely employed as the rehydration and maintenance solution of choice in the operation theatre (White and Goldhill 1997). Often, it is given to diabetic patients as an alternative to glucose solutions. Lactate is a gluconeogenic precursor, and the rate of gluconeogenesis may be enhanced in diabetes, particularly in situation of stress such as surgery. Infusion of lactate may have unwanted metabolic effects in diabetic patients.

There are limited studies on glycaemic control in diabetic patients using Ringers lactate. In a study by Thomas and Alberti, they made a comparison between three groups of patients. Group 1 (normal patients receiving one litre Ringer's lactate) has a significant increase in blood glucose level (55%). Group 2 (NIDDM patients not receiving any intravenous fluids) had only 22% significant increase in blood glucose level. Group 3 (NIDDM patients receiving one litre Ringer's lactate) produce the largest significant increase in blood

glucose level at 88% (Thomas 1978). When the percentage increase in plasma glucose was compared in diabetic patients with or without Ringer's lactate solution, the difference was highly significant. Demographically, the above study has a similar pattern to this study, except that the Thomas and Alberti study has a smaller sample (five samples in each group), being premedicated and his patients were absolutely fasted at least for six hours with no dextrose 5% infusion administered. In this study, all patients were not premedicated and were given normal maintenance at 100 mls/hour of dextrose 5% to prevent the occurrence of hypoglycaemia. Patients in Group 2 had an increase in mean blood glucose level of 1.50 mmol/L (19%) in comparison with patients in Group 1 which had only 0.96 mmol/L (13%) which was not statistically significant. However, when compared to the Thomas and Alberti study, this study shows a marked less increase in mean blood glucose level (19% compared to 88%).

There are other confounding factors which may influence peri-operative glycaemic control such as catabolic factor, type of solutions and type of surgery. Fasting with a maintenance of intravenous dextrose 5% solution gives a better glycaemic control preoperatively than those without it. This has been shown in another study by Rauoules, Lugin and Boussofara (1994), in which an infusion of dextrose 5% at 125 mls/hr maintains the glycaemic control perioperatively. Furthermore, normal saline is a non lactated solution, therefore, a smaller increase in mean blood glucose level is expected when compared to Ringer's lactate.

In emergency cases, the rate of increase in glucose disappearance in response to an increase in insulin concentration is impaired in people with NIDDM (Turk 1995). Usually, in emergency cases, patients are not well optimised and it is assumed the stress response is much greater. Thus, most of the time the

glycaemic control is poor to start with. This will invariably affect the glycaemic control perioperatively. Even though it has not been specifically analysed in this study, it may contribute to a significant higher increase in mean blood glucose level seen in Group 2.

In conclusion, we found that the glycaemic control was worsened with the use of Ringer's lactate solution. Therefore, we recommend that it is better to avoid lactated solution in patients with NIDDM, especially when the preoperative glycaemic control is already poor to start with.

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