TIME TO NORMALISATION OF TEMPERATURE AS A PREDICTOR OF OUTCOME IN PATIENTS ADMITTED WITH INADVERTENT POSTOPERATIVE HYPOTHERMIA IN THE SURGICAL INTENSIVE CARE UNIT

A dissertation submitted in partial fulfillment of the requirements for the MD Anaesthesiology examination(branch X) of the Tamil Nadu Dr.M.G.R Medical University to be held in April 2013

CERTIFICATE

This is to certify that **"Time to normalisation of temperature as a predictor of outcome in patients admitted with inadvertent postoperative hypothermia in the surgical intensive care unit "** is a bonafide work of Dr.Tryphena Selwyn in partial fulfillment of the requirements for the M.D. Anaesthesiology examination (Branch X) of The Tamil Nadu Dr.M.G.R Medical University to be held in April 2013.

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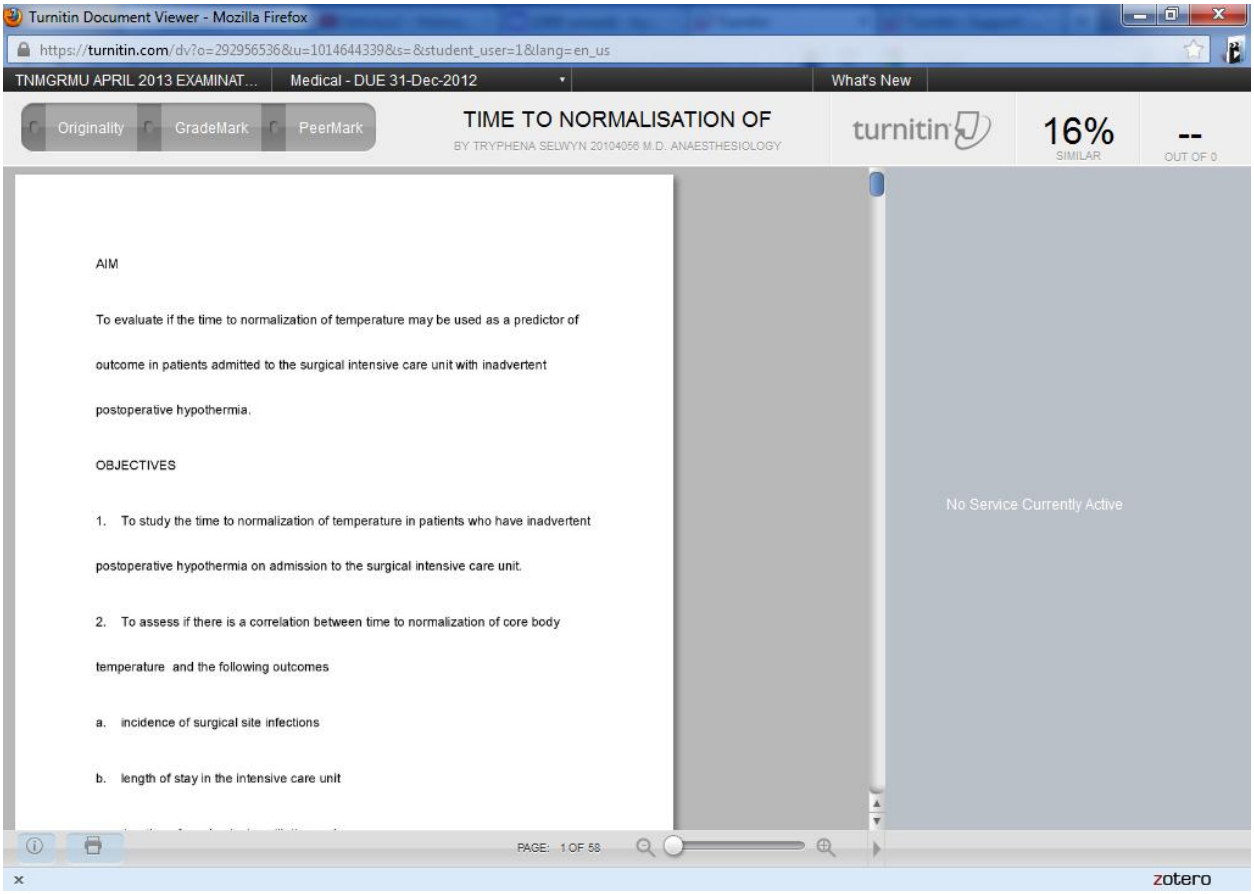
ORIGINALITY REPORT



CONTENTS

ABSTRACT

TITLE : TIME TO NORMALISATION OF TEMPERATURE AS A PREDICTOR OF OUTCOME IN PATIENTS ADMITTED TO THE SURGICAL INTENSIVE CARE UNIT WITH INADVERTENT POSTOPERATIVE HYPOTHERMIA

DEPARTMENT : ANAESTHESIA

NAME OF THE CANDIDATE : TRYPHENA SELWYN

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NAME OF THE GUIDE : DR. NAGAMANI SEN

OBJECTIVES:

1. To evaluate if time to normalization of core body temperature affects outcomes such as
    - incidence of surgical site infections
    - number of days requiring mechanical ventilation
    - duration of SICU stay

METHODS:

76 patients admitted postoperatively to the surgical intensive care unit with inadvertent postoperative hypothermia(nasopharyngeal temperature of less than 36.5^0 C on admission) were included in the study. They were divided into 2 groups based on the time to normalization,to compare outcomes- 39 early normalisers (2 hours or less) and 37 delayed normalisers (more than 2 hours). The primary outcome was the incidence of surgical site infections. Secondary outcomes included ventilated days, arrhythmias,coagulation abnormalities and duration of ICU stay. Chi-square test was used to assess significance of difference in categorical variables and the independent t-test was used for continuous variables.

RESULTS:
Patients with delayed normalization of core hypothermia had an increased incidence of surgical site infections (7 in 37 patients versus 1 in 39 patients p-value 0.02),more number of ventilated days,(1.35 days versus 3.43 days p-value 0.008) and prolonged stay in the surgical intensive care unit(2.58 days versus 5.08 days p-value 0.002) as compared to the early normalisers. There was no significant difference in the incidence of arrhythmias(0.301), coagulopathy(p-value 0.638) , readmission to the SICU (p-value 0.115) or death(p-value 0.174) between the 2 groups.Prolonged time to normalisation of inadvertent postoperative core hypothermia may contribute adversely to the morbidity as described above.
KEYWORDS: time to normalization of temperature, hypothermia,surgical site infections

AIM

To evaluate if the time to normalization of temperature may be used as a predictor of outcome in patients admitted to the surgical intensive care unit with inadvertent postoperative hypothermia.

OBJECTIVES

1. To study the time to normalization of temperature in patients who have inadvertent postoperative hypothermia on admission to the surgical intensive care unit.
2. To assess if there is a correlation between time to normalization of core body temperature and the following outcomes

    a. incidence of surgical site infections
    b. length of stay in the intensive care unit
    c. duration of mechanical ventilation and
    d. mortality
3. To evaluate for risk factors that may have led to inadvertent postoperative hypothermia

NULL HYPOTHESIS

In patients with inadvertent postoperative hypothermia, delayed normalization of core body temperature is associated with worse outcomes when compared with those in whom temperature normalizes rapidly

LITERATURE REVIEW

NORMAL THERMOREGULATION

Humans are warm blooded and thermoregulation is a vital part of maintaining homeostasis. When the thermoregulatory mechanisms are overwhelmed, hypothermia or hyperthermia results depending on the original insult and the surrounding temperature. Normally the human body's temperature is tightly regulated and it was recognized as early as 1912 that the hypothalamus was the principle control centre for thermoregulation in mammals. This conclusion was reached after noting the labile body temperatures in individuals in whom the hypothalamus was destroyed. The skin and other tissues send afferent thermal signals to the hypothalamus and we now know that a certain degree of "pre-processing" occurs while the thermal signal is being relayed (1). Thermoregulatory information is processed in 3 phases (2):

- afferent thermal sensing,
- central regulation, and
- efferent responses

Afferent thermal sensing is done mainly by the skin. The human skin is exquisitely sensitive to temperature and a difference of as small as 0.003 °C can be detected. However the ability to influence the thermoregulation is not present in equal measure throughout the skin. Some areas such as the face are much more sensitive to changes in temperature than others.

Cold signals from the skin are carried primarily *via* Aδ nerve fibers, whereas warm signals are relayed by unmyelinated C fibers.(3)The search for the specific receptors that receive the impulse went on for many years and has yielded some new findings. Transient receptor potential (TRP) menthol (M) and vanilloid (V) receptors have been demonstrated to be the principle temperature sensing elements in both skin and the dorsal root ganglia. They are notable for having exquisitely high temperature sensitivity. They tend to change their activity by more than a

factor of 10 over a 10°C range (Q10 > 10). TRPV1-4 receptors are activated by heat, whereas TRPA1 and TRPM8 are cold activated.(4)

Central regulation is predominantly done at the hypothalamus but occurs in the spinal cord and the brainstem as well. The afferent input coming in from all over the body is integrated in these areas. The anterior hypothalamus is the centre for autonomic control and the posterior hypothalamus serves as the centre for behavioral control. The spinal cord has also been shown to be a source of extrahypothalamic thermoregulatory control. This is evidenced by the fact that patients with high spinal cord transections may be subject to labile body temperature although they are not completely poikilothermic.(5)Daniel Sessler has defined gain and maximum intensity as follows.The *gain* of a thermoregulatory response is defined as the slope of response intensity versus core temperature. A point is reached when the response intensity no longer increases with further deviation in core temperature. This point is said to be the *maximum intensity* of the response.(2) Normal core temperatures in humans usually fall in the range of 36.5°C to 37.5°C; temperatures less than 36°C or greater than 38°C may indicate loss of control or an extreme thermal environment that overcomes thermoregulatory defenses.

A lot remains unclear about the extent to which temperature and time dependant factors contribute to our thermoregulatory control. We still have not deciphered exactly how the body is able to determine absolute threshold temperatures. Research on rats suggest that this may be due to inhibitory postsynaptic potentials in the hypothalamic neurons(6) modulated by neurotransmitters such as norepinephrine, dopamine, 5-hydroxytryptamine, acetylcholine, prostaglandin E_1, and neuropeptides.

The ***interthreshold range*** refers to the range of temperatures within which sensing occurs accurately but does not trigger an autonomic thermoregulatory response. It is bounded by the

sweating threshold on one extreme and the vasoconstriction threshold on the other end. The interthreshold range is said to be only 0.2°-0.4°C in humans.(7)(Refer Fig.1)

Efferent responses are created in response to thermal perturbations and they may either promote heat loss to the environment or metabolic production of heat depending on the afferent thermal signal that was sensed. I have restricted this review to the efferent responses to a cold stimulus. These include behavioral regulation, vasomotion, shivering and non-shivering thermogenesis.

- ***Behavioral regulation***: In response to a cold environment , we tend to wear warm clothes or seek to adjust the surrounding temperature to a more comfortable value using an air cooler or conditioner. This is possible only at a conscious level . It has been found that humans tend to perceive smaller changes in skin temperature more accurately as compared to changes in the core body temperature. Thus the skin temperature mediates about half of behavioral thermoregulation (8)while contributing only 20-30% to the autonomic thermoregulatory defenses(9)
- ***Vasomotion:*** The blood flow to the skin is divided as nutrional and thermoregulatory flow. Nutritional blood flow occurs through capillaries which are 10 μm in diameter. In contrast, thermoregulatory blood flow occurs through arteriovenous shunts which are typically 100 μm in diameter and hence can allow 10000 fold the blood flow through a comparable length of the capillary.(10) The bood flow through these shunts accounts for upto 10% of the total cardiac output and vasoconstriction of these conduits can raise the blood pressure by as much as 15 mm Hg.(11) These shunts are mainly in the acral regions such as the fingers,toes,nose etc and respond to α-adrenergic receptor stimulation by

noradrenaline released from sympathetic nerves . They are relatively resistant to regional temperature changes and depend on the central thermoregulatory control.

- ***Non-shivering thermogenesis:*** This is defined as an increase in the metabolic heat production in the body which does not involve muscular activity. This is achieved through metabolism in the mitochondria-rich brown adipose tissue. However it's contribution is relatively insignificant in adult humans(2).
- ***Shivering:*** Shivering is an irregular tremor that occurs simultaneously in all muscles throughout the body. On electromyography these have been demonstrated to be randomly overlapping depolarization spikes of the myofibril. The shivering threshold is 1°C lower than the vasoconstriction threshold and therefore is actually a last resort response to a cold environment(12).

THERMOREGULATION UNDER ANAESTHESIA

GENERAL ANAESTHESIA

Normally there is a tonic vasoconstriction which ensures that there is a large core to periphery temperature gradient.All general anaesthetic agents impair this vasoconstriction.Under anaesthesia the patient is unable to respond to thermal perturbations with behavioral regulation. They rely on autonomic thermoregulatory control and manipulation of the external environment. It has also been demonstrated that all anaesthetic agents impair the autonomic thermoregulatory control. The cold response threshold is lowered considerably while the warm threshold is raised slightly. The interthreshold range increases 10-fold to approximately 2°-4°C(13,14,15,16). Refer figure 2)

Warm defenses are relatively well preserved under anaesthesia. The sweating threshold is slightly increased by propofol(14),alfentanil(13), dexmedetomidine(15), isoflurane(17) and desflurane(16) . This translates into the fact that inadvertent hyperthermia is quite rare even when forced air warmers are used since they are able to dissipate the heat into the dry environment. However the circulating water garments are more likely to cause inadvertent hyperthermia since they are impervious to moisture and prevent evaporative heat loss.

A linear decrease in the vasoconstriction and shivering thresholds is produced by propofol(14), alfentanil(13) and dexmedetomidine(15). A non-linear decrease in the cold-response thresholds is produced by isoflurane(17) and desflurane(16).This means that these volatile anaesthetic agents will inhibit shivering and vasoconstriction less than propofol at low concentrations but more than propofol at the concentrations typically used for anaesthetic effect. It is interesting to

note that the 1°C difference between the shivering and vasoconstriction thresholds is maintained under general anaesthesia. The only exception to this is pethidine, which has been shown to decrease the shivering threshold twice as much as the vasoconstriction threshold(18).

PATTERN OF HEAT LOSS AND GAIN IN NON-ANAESTHETISED HUMANS(19)

The following diagram illustrates the pattern of heat loss and gain in non-anaesthetized humans.

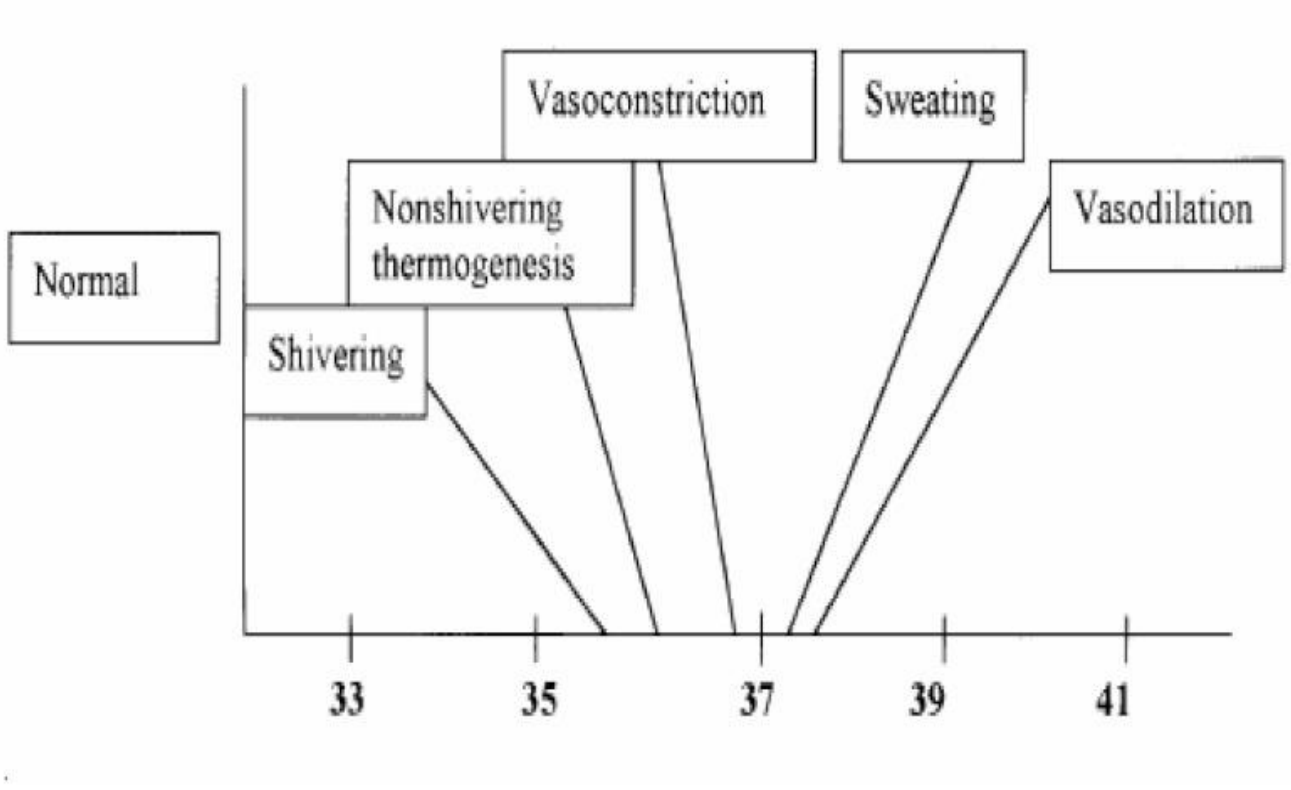


Figure 1

PATTERN OF HEAT LOSS AND GAIN IN ANAESTHETISED HUMANS(19)

The following diagram illustrates the pattern of heat loss and gain in anaesthetized humans.

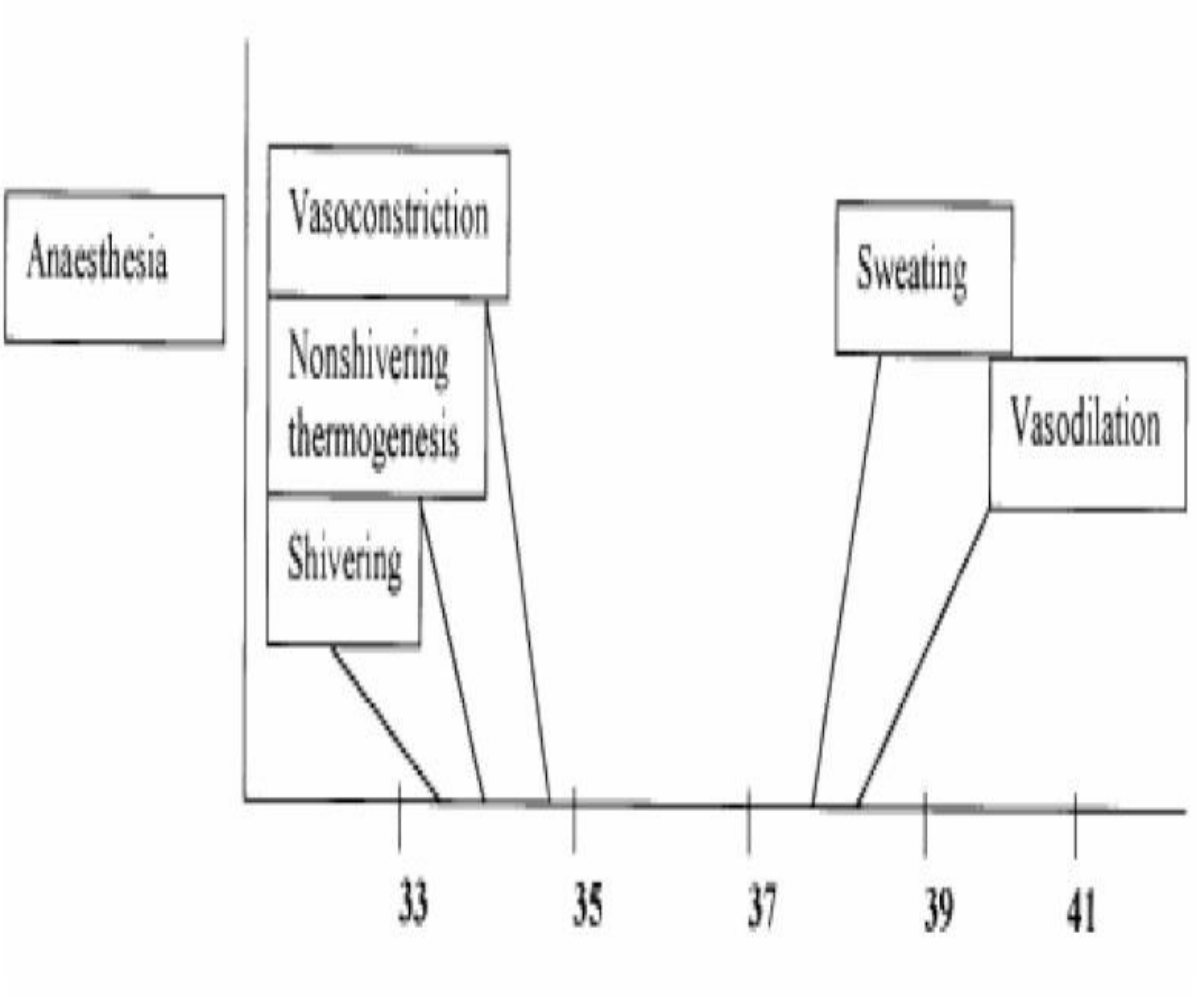


Figure 2

TYPICAL PATTERN OF HEAT LOSS DURING GENERAL ANAESTHESIA(19)

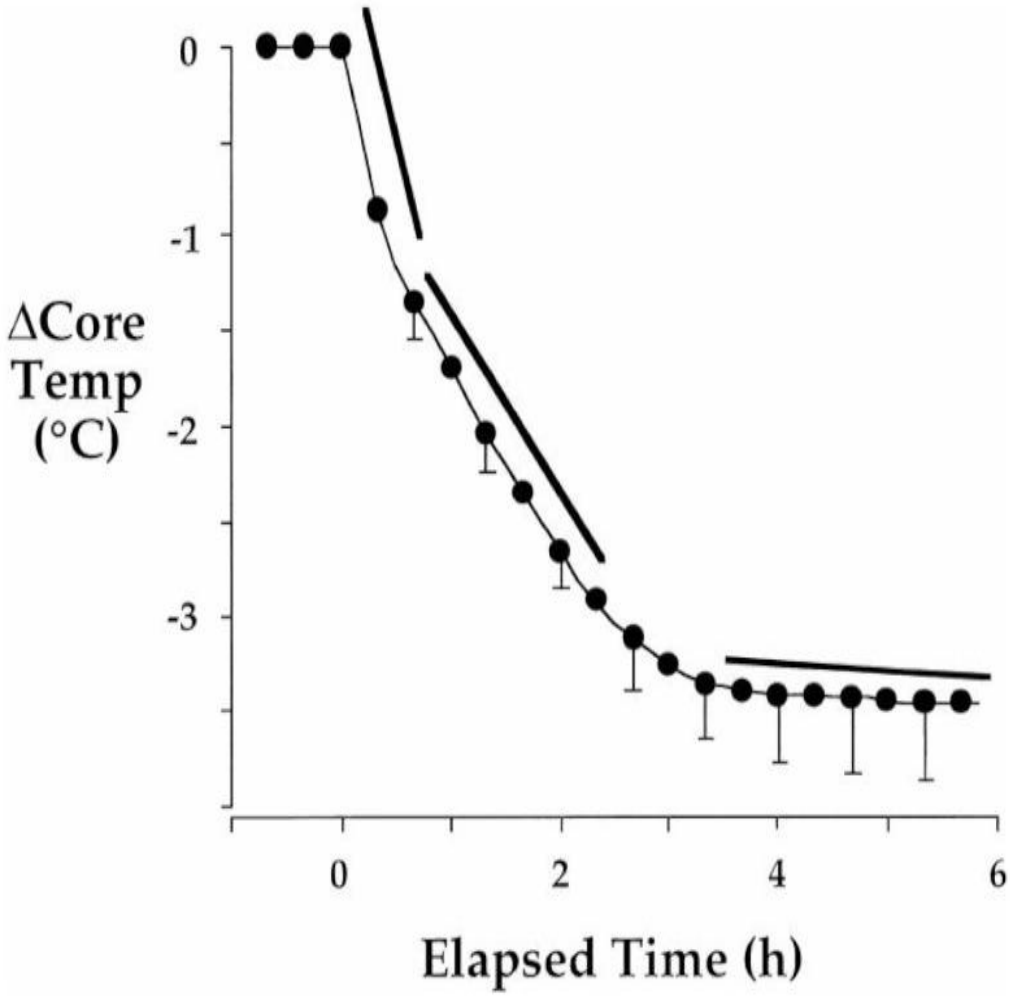
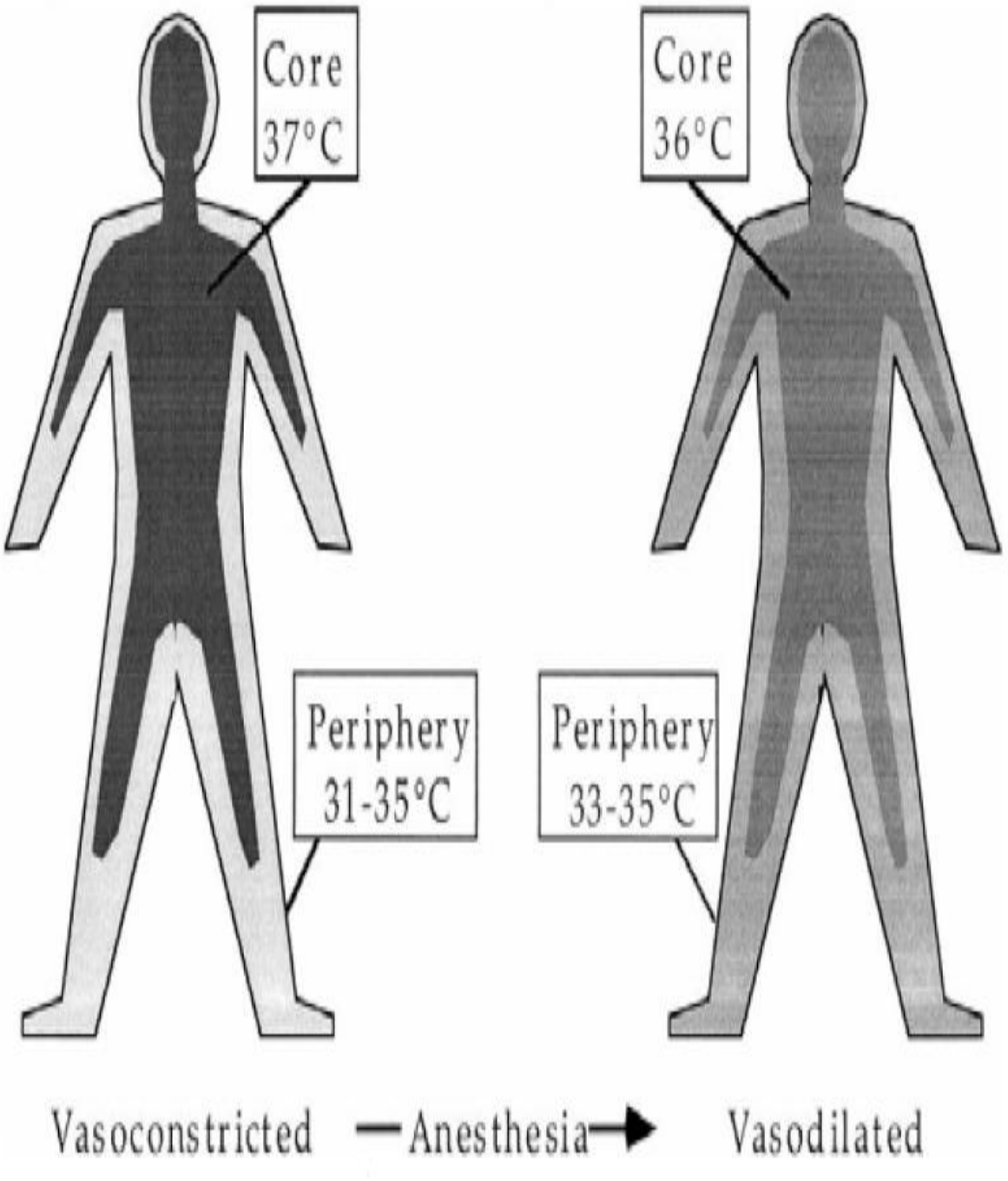


Figure 3

The development of hypothermia under general anaesthesia may be divided into 3 phases (20)(Refer figure 3)

- There is an *initial rapid reduction* of core body temperature due to internal redistribution of body heat that sets in soon after induction.
- This is followed by a *linear decrease* in core temperature at a rate determined by the difference between heat loss and production.
- When the patient is sufficiently hypothermic,it triggers the *thermoregulatory vasoconstriction* which then restricts the core to peripheral flow of heat and creates a plateau phase.

REDISTRIBUTION HYPOTHERMIA AFTER INDUCTION OF GENERAL ANAESTHESIA



THERMOREGULATION UNDER REGIONAL ANAESTHESIA

Under regional anaesthesia the first phase remains the same. The redistribution of heat occurs mainly to the lower limbs as there is vasodilatation secondary to the sympathetic blockade. This is followed by the linear decrease at a rate determined by the difference between the heat loss and production. However this phase is not discontinued by the onset of thermoregulatory vasoconstriction in the lower limbs due to the ongoing sympathetic blockade there. Hence patients undergoing prolonged surgery under neuraxial blockade are highly prone to develop hypothermia if active warming measures are not instituted(20).

NICE GUIDELINES TO PREVENT INADVERTENT PERIOPERATIVE HYPOTHERMIA

The National Institute for Health and Clinical Excellence has published a guideline that aims to prevent inadvertent perioperative hypothermia. It has suggestions for the preoperative ,intraoperative and postoperative phases. (21)

PREOPERATIVE PHASE

It is important to take measures to prevent perioperative hypothermia. The first step is to identify individuals at high risk for perioperative hypothermia. If any 2 of the following are present, the patient is at a high risk for perioperative hypothermia:

1. ASA grade 2 to 5(the higher the grade the greater the risk)
2. Preoperative temperature below 36 °C(and preoperative warming is not possible because of clinical urgency)
3. Undergoing combined general and regional anaesthesia
4. Undergoing major or intermediate surgery
5. At risk of cardiovascular complications.

The patient's temperature should be measured and documented in the hour before they leave the ward or the emergency department. If the patient's temperature is below 36°C:

- Forced air warming should be started preoperatively in the ward or in the emergency department(unless there is a need to expedite surgery due to clinical urgency).
- Forced air warming should be maintained throughout the intraoperative phase.

INTRAOPERATIVE PHASE

- Patient's temperature should be measured and documented before the induction of anaesthesia and then every 30 minutes until the end of surgery.
- Standard critical incident reporting should be considered for any patient arriving at the theatre suite with a temperature below 36°C
- Induction of anaesthesia should not begin unless the patient's temperature is 36°C or above (unless there is need to expedite surgery due to clinical urgency)
- In the theatre suite :

    1. The ambient temperature should be atleast 21 °C while the patient is exposed.
    2. Once forced air warming is established, the ambient temperature may be reduced to allow better working conditions.
    3. Using equipment to cool the surgical team should also be considered
    4. The patient should be adequately covered throughout the intraoperative phase to conserve heat and exposed only during surgical preparation.
    5. IV fluids(500 ml or more) and blood products should be warmed to 37 °C using a fluid warming device.
    6. a. Patients who are at higher risk of inadvertent perioperative hypothermia and who are having anaesthesia for less than 30 minutes should be warmed intraoperatively from induction of anaesthesia using a forced air warming device.

b.All patients who are having anaesthesia for longer than 30 minutes should be warmed intraoperatively from induction of anaesthesia using a forced air warming device.

7. The temperature setting on forced air warming devices should be set at maximum and then adjusted to maintain a patient temperature of atleast 36.5°C.
8. All irrigation fluids used intraoperatively should be warmed in a thermostatically controlled cabinet to a temperature of 38-40 °C

POSTOPERATIVE PHASE

This is defined as the 24 hours after the patient has entered the recovery area of the theatre suite.

The patient's temperature should be measured and documented on admission to the recovery room and then every 15 minutes

- Ward transfer should not be arranged unless the patient's temperature is 36°C or above.
- If the patient's temperature is below 36°C,they should be actively warmed using the forced air warming device until they are discharged from the recovery room or until they are comfortably warm.

Patient should be kept comfortably warm when back in the ward.

- Their temperature should be measured and documented on arrival at the ward.
- Their temperature should then be measured and documented as part of routine 4 hourly observations.
- They should be provided with atleast one cotton sheet plus 2 blankets or a duvet.

If the patient's temperature falls below 36°C while in the ward:

- They should be warmed using forced air warming until they are comfortably warm
- Their temperature should be measured and documented atleast every 30 minutes during warming.

TEMPERATURE MEASUREMENT IN THE CRITICALLY ILL

Temperature is one of the important vital signs that need to be constantly monitored in a critically ill patient. The temperature in the pulmonary artery is credited to accurately mirror the core body temperature. However inserting a pulmonary artery catheter is quite invasive and the risk may outweigh the benefit especially if the patient does not have an indication apart from the purpose of temperature monitoring .Lefrant et al studied the temperature measurement in various sites in intensive care patients. They used the Bland-Altman method to compare between the different methods of temperature measurement. The mean differences between pulmonary artery temperatures and those of the different methods studied were: oesophageal (0.11+/-0.30 degrees C), rectal (-0.07+/-0.40 degrees C), axillary (0.27+/-0.45 degrees C), inguinal (0.17+/-0.48 degrees C), urinary bladder (-0.21+/-0.20 degrees C). They concluded that in critically ill patients the urinary bladder temperature and the electronically measured esophageal temperature were more accurate than the rectal temperature which in turn was more accurate than the ingunal or axillary temperatures.(22) In another study by Akata et al, nasopharyngeal temperature was demonstrated to be next to the pulmonary artery catheter in precisely detecting changes during deep hypothermic cardiopulmonary bypass with the rank order being pulmonary artery ≥nasopharynx > forehead > bladder > fingertip (23). The advantage of the nasopharyngeal probe is that it is easy to insert and non-invasive . The distance from the tragus to the ala nasi is measured and is used to indicate the location of the nasopharynx. The nasopharyngeal probe is inserted to that measured distance and secured. In our study even patients who were not intubated were found to tolerate the nasopharyngeal probe well.

SURGICAL WOUND HEALING

There are 4 stages of normal surgical wound healing:.(24)

STAGE	Cellular and Bio-physiologic Events
Hemostasis	• vascularconstriction • platelet aggregation, • degranulation, and fibrin formation (thrombus)
Inflammation	• neutrophil infiltration • monocyte infiltration and differentiation to macrophage • lymphocyte infiltration
Proliferation	• re-epithelialization • angiogenesis • collagen synthesis • Extracellular matrix formation
Remodeling	• collagen remodeling • vascular maturation and regression

The following are some of the factors that affect wound healing.(24)

Local Factors

- Oxygenation
- Infection
- Foreign body
- Venous sufficiency

Systemic Factors

- Age and gender
- Sex hormones
- Stress
- Ischemia
- Diseases: diabetes, keloids, fibrosis, hereditary healing disorders, jaundice, uremia
- Obesity
- Medications: glucocorticoid steroids, non-steroidal anti-inflammatory drugs, chemotherapy
- Alcoholism and smoking
- Immunocompromised conditions: cancer, radiation therapy, AIDS
- Nutrition

EFFECTS OF INADVERTENT PERIOPERATIVE HYPOTHERMIA

Hypothermia has been extensively studied both for it's beneficial role in deep hypothermic cardiac arrest for complex intracardiac repair ,in head injury and in post-cardiac arrest resuscitation situations. However in the surgical scenario multiple studies have been done to show that it has deleterious effects as well.

SURGICAL WOUND INFECTION

Kurz et al demonstrated the increase in surgical site infections in hypothermic patients as compared to normothermic patients.They studied 200 patients and found the incidence of surgical site infections as 6% in the normothermic group and 19% in the hypothermic group($p < 0.01$) Hypothermia has been shown to trigger subcutaneous vasoconstriction and this in turn decreases the subcutaneous oxygen tension. The incidence of surgical site infections has been shown to correlate with the subcutaneous oxygen tension.(25) Hypothermia also directly impairs immune function by 2 mechanisms- impaired non-specific oxidative killing of bacteria by neutrophils and impaired T-cell mediated antibody production.(26)

DURATION OF HOSPITALISATION

Hypothermia has been shown to have many complications and by virtue of these ,the duration of hospitalization has been shown to be prolonged in these patients. Kurz et al showed that for a difference of 1.9°C in core temperature , the mean duration of stay in normothermic patients was 12.1±4.4 days and in hypothermic patients it was 14.7±6.5 days($p < 0.01$). Thus the duration of hospitalization was shown to be increased by 2.6 days or approximately 20%, which is a clinically significant result.(27)

INTRAOPERATIVE BLOOD LOSS AND TRANSFUSION REQUIREMENTS

Hypothermia impairs the release of thrombaxane A2, which is required for the formation of the initial platelet plug. Enzymes in the coagulation cascade are also temperature dependent and their action is impaired with hypothermia. This latter effect may be unrecognized clinically since the lab coagulation tests are performed at 37°C, regardless of the patient's temperature. (28)In a meta analysis and systematic review, Rajagopalan et al established that even mild hypothermia (<1 °C) significantly increases blood loss by approximately 16% (4-26%). It was also demonstrated to increase the relative risk for transfusion by approximately 22% (3-37%). Maintaining perioperative normothermia reduces blood loss and transfusion requirement by clinically important amounts.(29)

MORBID CARDIAC EVENTS

In a randomized clinical trial, Frank et al demonstrated that perioperative morbid cardiac events were less likely to occur in the normothermic patient as opposed to the hypothermic patient(1.4% vs 6.3%; P=.02). Hypothermia was shown to be an independent predictor of morbid cardiac events by multivariate analysis as well. The incidence of postoperative ventricular tachycardia was 7.9% in the hypothermic group and 2.4% in the normothermic group (p=0.04)(30)

MATERIALS AND METHODS

The study was designed as an observational inception cohort study. There was no intervention. The study was conducted in the surgical intensive care unit of Christian Medical College and Hospital (CMCH) from September 2011 to September 2012, after obtaining approval by the Institutional Review Board and the Ethics committee.

STUDY POPULATION

INCLUSION CRITERIA

This study was conducted on all patients aged more than 16 years admitted to the surgical intensive care unit of the CMCH, Vellore fulfilling the following criteria:

Post-operative patients requiring admission in SICU after a laparotomy, both elective and emergency, who were hypothermic at arrival. Hypothermia being defined as core body temperature, as measured by a nasopharyngeal temperature probe, less than 36.5 degree Celsius.

EXCLUSION CRITERIA

Patients were excluded from the study if:

- Age was less than 16 years
- The patient underwent another operation in addition to the laparotomy at the same sitting (eg. Polytrauma)

SAMPLE SIZE CALCULATION:

Using the sample size calculator for cohort studies in openepi.com the sample size of 76 was derived. The two-sided confidence interval was taken to be 95%, the power was 80% ,ratio of unexposed to exposed was taken as 1:1, the percent of unexposed with the outcome was taken to be 10% and the percent of unexposed with the outcome was taken to be 40% from a preliminary pilot study done on 20 patients . 38 patients were to be in each arm. In our study there are 39 patients in one arm and 37 in the other arm after deleting incomplete data entry records.

SETTING

Surgical intensive care unit, Christian Medical College ,Vellore

METHOD

All post-operative laparotomy patients received in the surgical intensive care unit had their core body hypothermia measured on admission. This was done by insertion of a nasopharyngeal temperature probe on arrival in SICU.The distance between the tragus and the ala nasi was measured and the probe was inserted to that depth and secured . If the temperature was 36.5 degree Centigrade or less the patient was recruited in the study.

The nasopharygeal temperature has been shown to correlate closely with core body temperature as measured by the pulmonary artery catheter. The nasopharyngeal temperature probe was well tolerated by patients who were extubated as well. In these patients it was inserted in the same nostril as the nasogastric tube in order to avoid further discomfort. Since the nasogastric tube was not used to feed the patient in the first day for any of the patients , the temperature could be relied on. The temperature at admission was recorded and subsequent readings were noted every hour until the temperature rose above 36.5°C.

All the hypothermic patients received active warming measures which was defined as forced air warming using a compatible blanket (Bair Hugger),on arrival in the intensive care unit.

The measure of the severity of the illness at admission to the ICU was done by the APACHE II (Acute Physiological and Chronic Health Evaluation II) Severity of Disease Classification System scoring(see Annexure). Details of the intraoperative period were retrospectively gleaned from the patient's anaesthesia record. These included the preoperative diagnosis, intraoperative diagnosis, operation performed,duration of the operation, type of anaesthesia, amount of

intravenous fluids infused, blood or blood product transfusion,details of temperature monitoring,arterial blood gas values showing metabolic acidosis.

Details of the ICU admission and postoperative period were prospectively gathered.These included the nasopharyngeal temperature on admission to the intensive care unit, the time to normalisation of core body temperature, occurrence of shivering,metabolic acidosis,coagulopathy,cardiac arrhythmias, surgical site infections,ventilator associated pneumonia,duration of mechanical ventilation, duration of stay in the intensive care unit, readmission to the intensive care unit and death.

The data collection sheet is included in the Annexure.

OUTCOMES

PRIMARY OUTCOME

Incidence of surgical site infections

SECONDARY OUTCOMES

Incidence of cardiac arrhythmias

Incidence of coagulopathy

Number of days requiring mechanical ventilation

Incidence of ventilator associated pneumonia

Duration of stay in the intensive care unit

Readmission to the intensive care unit

Death

STATISTICAL ANALYSIS

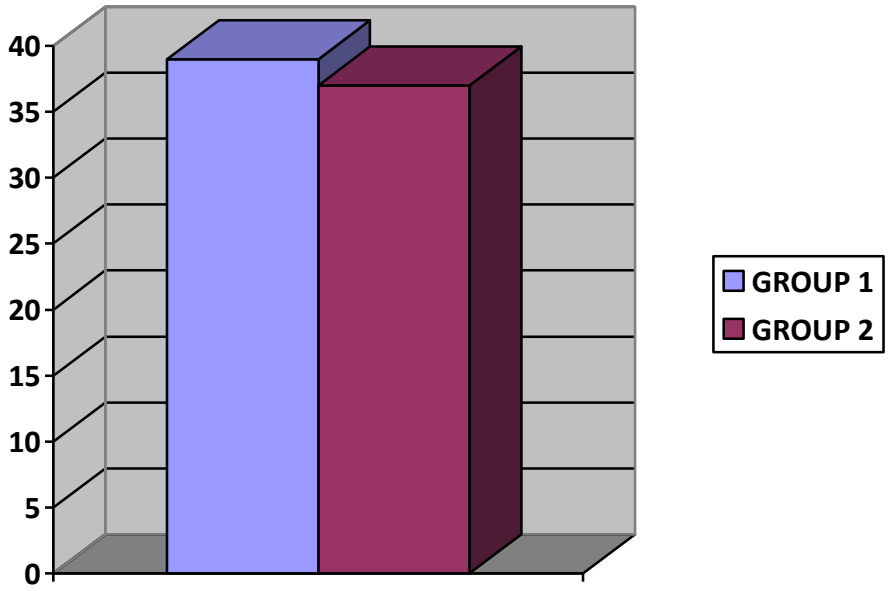
Continuous data are presented as mean ± SD. Mean values were compared by independent student's t-test. Pearson's Chi square test was used for comparing the categorical variables. Skewed distributions were compared using the Mann-Whitney U test.A p- value of < 0.05 was considered statistically significant. Logistic regression analysis was used to study the effect of adjusted and unadjusted factors on the primary outcome. All analysis was conducted using SPSS 16(Statistical Package for Social Sciences).

RESULTS

76 patients consecutive hypothermic patients admitted in the surgical intensive care unit between September 2011 and September 2012 were recruited and analysed. The patients were divided into 2 groups based on the time to normalization of temperature. Since there is no published data on what time may be used to define early and late normalization ,the median time to normalization was used to create the divisions.The median time to normalization was found to be 2 hours. Based on this the patients were divided into 2 groups as follows.

GROUP 1- Patients who took 2 hours or less to reach a core body temperature of 36.5°C (***early normalisers***).There were 39 patients in this group.

GROUP 2- Patients who took more than 2 hours to reach a core body temperature of 36.5°C (***delayed normalisers***). There were 37 patients in this group.



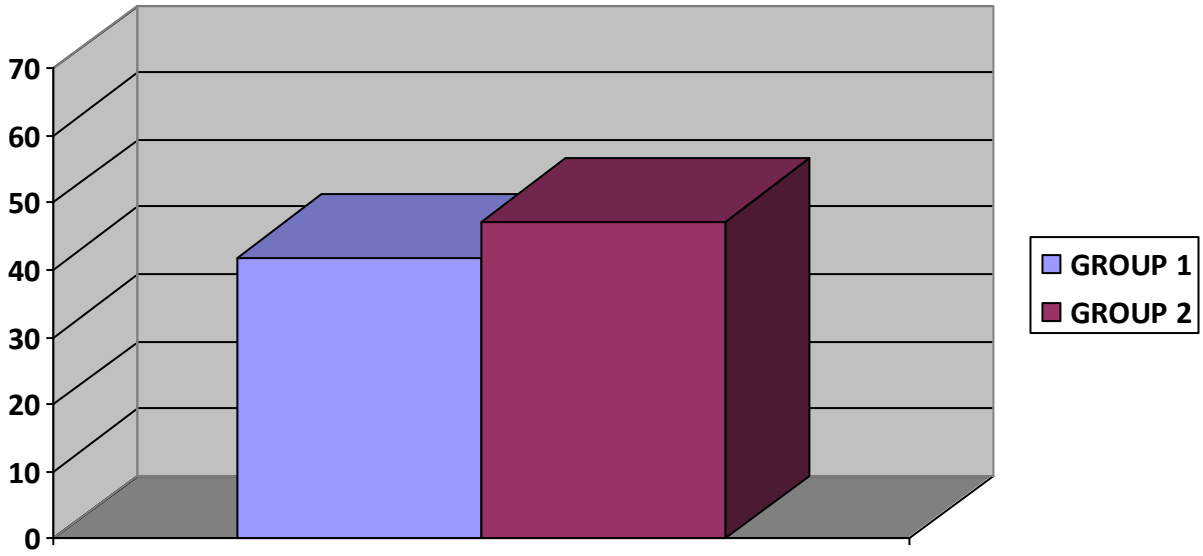
The variables were compared between these two groups to see if there was a difference in outcome .

DEMOGRAPHICS

AGE

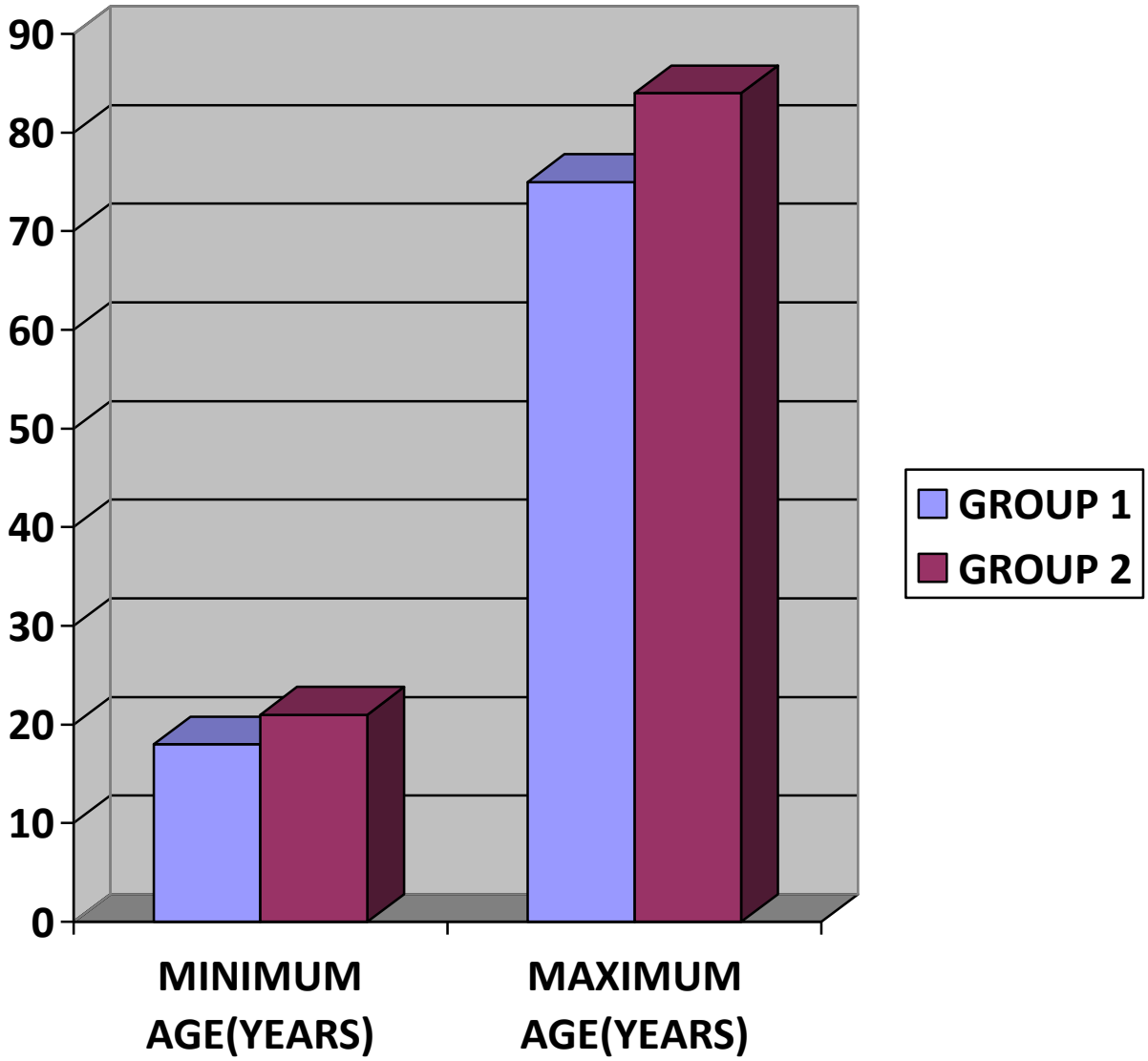
	MEAN AGE(YEARS)
GROUP 1	41.9
GROUP 2	47.1

On comparing the two means ,the independent students T-test showed a p-value of 0.068 which means that there was no significant difference in the mean age of the patients between the 2 groups .



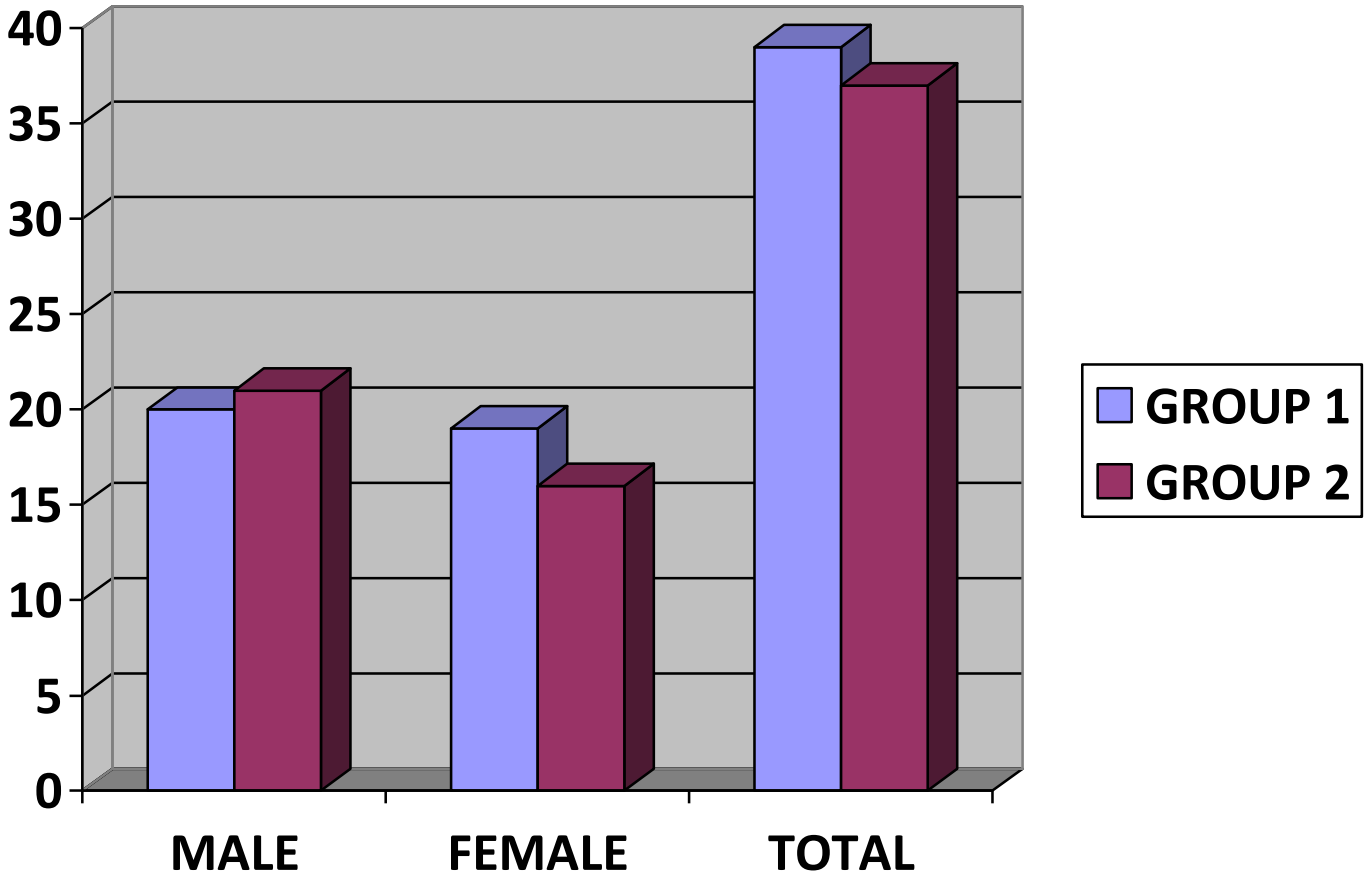
AGE- RANGE

	MINIMUM AGE(YEARS)	MAXIMUM AGE(YEARS)
GROUP 1	18	75
GROUP 2	21	84



SEX

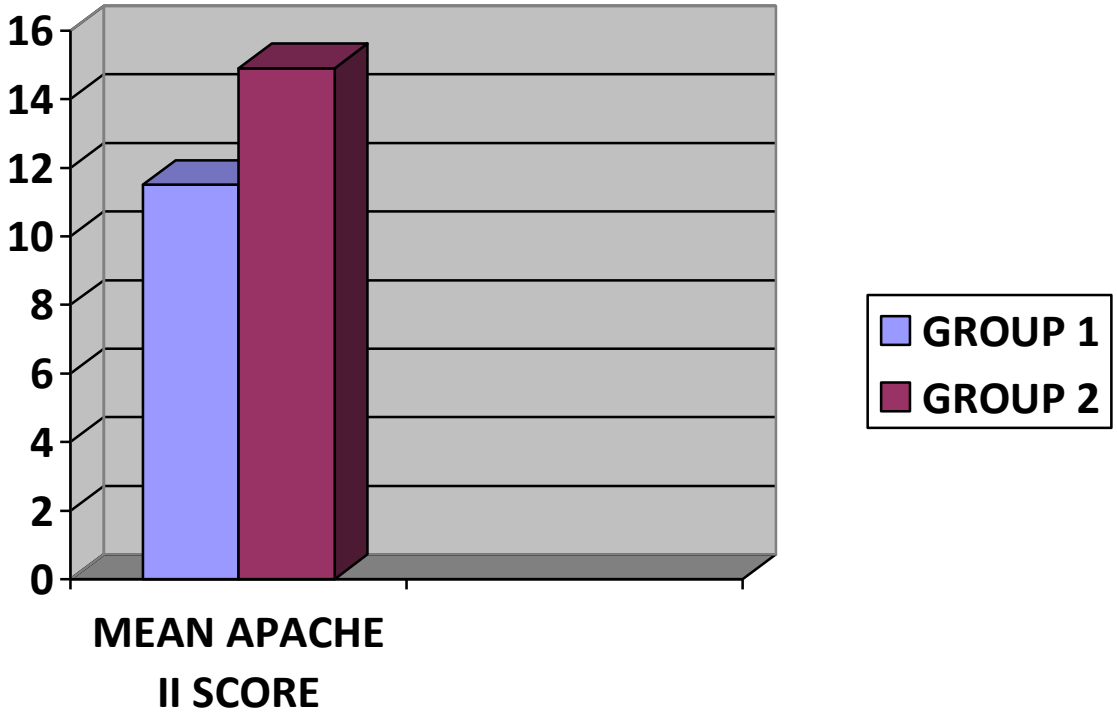
	MALE	FEMALE	TOTAL
GROUP 1	20	19	39
GROUP 2	21	16	37



The Pearson Chi- square test showed a p value of 0.632 which means that there is no significant difference in distribution of sexes between the 2 groups.

APACHE II SCORE

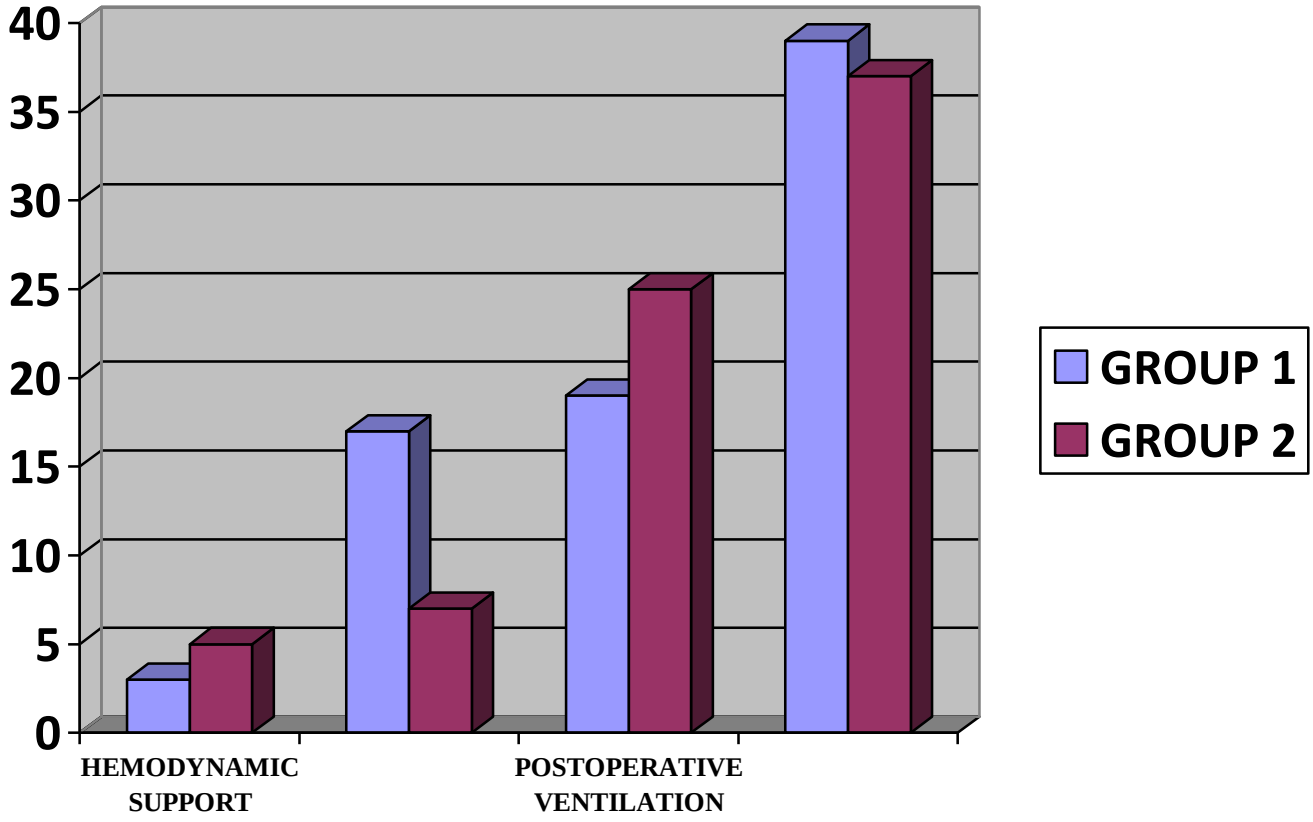
	MEAN APACHE II SCORE	STANDARD DEVIATION
GROUP 1	11.5	3.97
GROUP 2	14.9	5.55



The independent students T-test showed that there was a significant difference between the mean APACHE scores in the two groups(p-value 0.003). The patients in group 2 had a higher APACHE score indicating that they were sicker as compared to group 1. This may have been a contributing factor to them having taken a longer time to normalise their core body temperature.

PRIMARY REASON FOR ADMISSION IN THE SURGICAL INTENSIVE CARE UNIT

	HEMODYNAMIC SUPPORT	MONITORING	POSTOPERATIVE VENTILATION	TOTAL
GROUP 1	3(7.7%)	17(43.6%)	19(48.7%)	39
GROUP 2	5(13.5%)	7(18.9%)	25(67.6%)	37

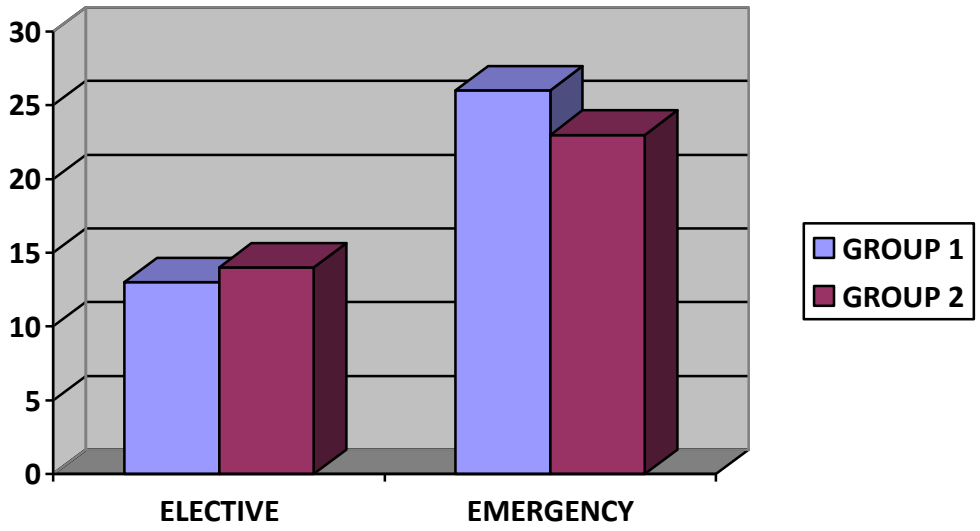


The primary reason for admission in SICU was postoperative ventilation in majority of the patients in both groups.

PRIORITY

The following is the distribution of cases depending on priority of surgery- either elective or emergency.

	ELECTIVE	EMERGENCY
GROUP 1	13 (33.3%)	26 (66.7%)
GROUP 2	14(37.8%)	23(62.2%)



The statistics show that in both the groups the majority of cases were those who underwent emergency surgery. Patients are probably more prone to develop inadvertent hypothermia while undergoing emergency surgery due to factors such as absence of pre-warming, non-availabilty of warm fluids or forced air warmers and also more requirement of fluids as well as blood or blood products for the purpose of acute resuscitation.

CLASSIFICATION OF SURGERY

	MAJOR	MINOR
GROUP 1	39 (100%)	0
GROUP 2	37 (100%)	0

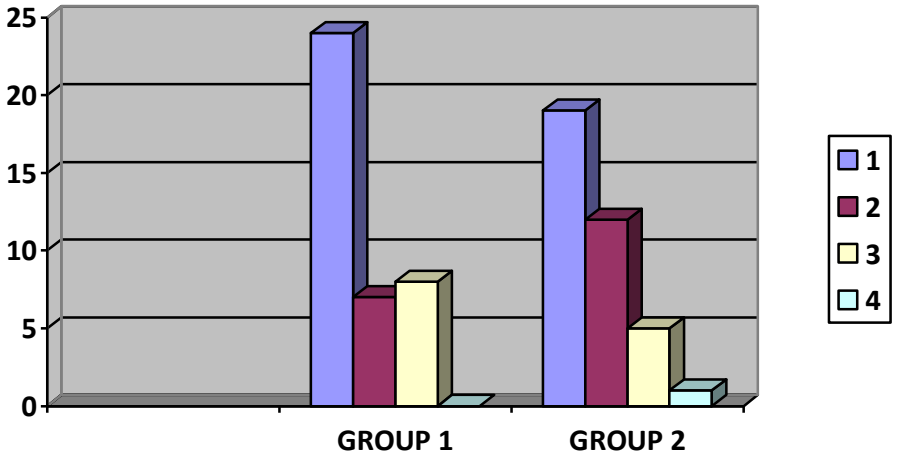
All the patients in the study had undergone laparotomies which were classified as major surgery.

The most common emergency surgery done was exploratory laparotomy with closure of perforated duodenal ulcer and peritoneal toileting. Elective surgeries that featured commonly were, hepatectomy, Whipple's procedure and radical cystectomy with ileal conduit.

ASA GRADE

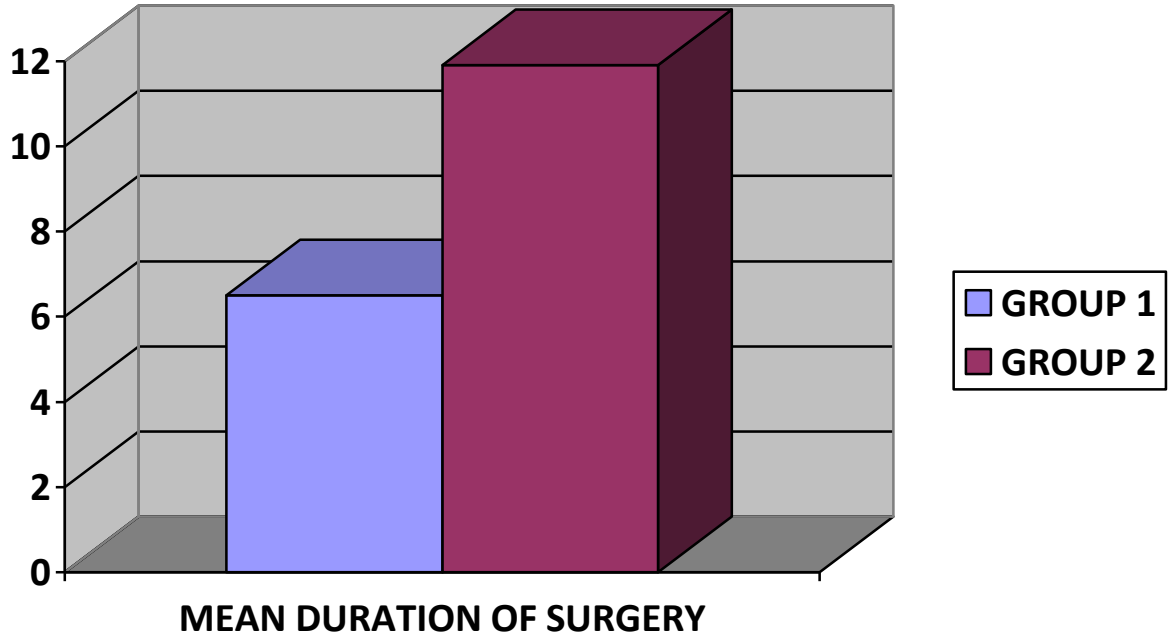
The following table shows the number of patients according to ASA grade among the 2 groups

ASA GRADE	GROUP 1	GROUP 2
1	24	19
2	7	12
3	8	5
4	0	1



DURATION OF SURGERY

	MEAN DURATION OF SURGERY	STANDARD DEVIATION
GROUP 1	6 hrs 36 min	3 hrs 46 min
GROUP 2	11hrs 55 min	3 hrs 57 min

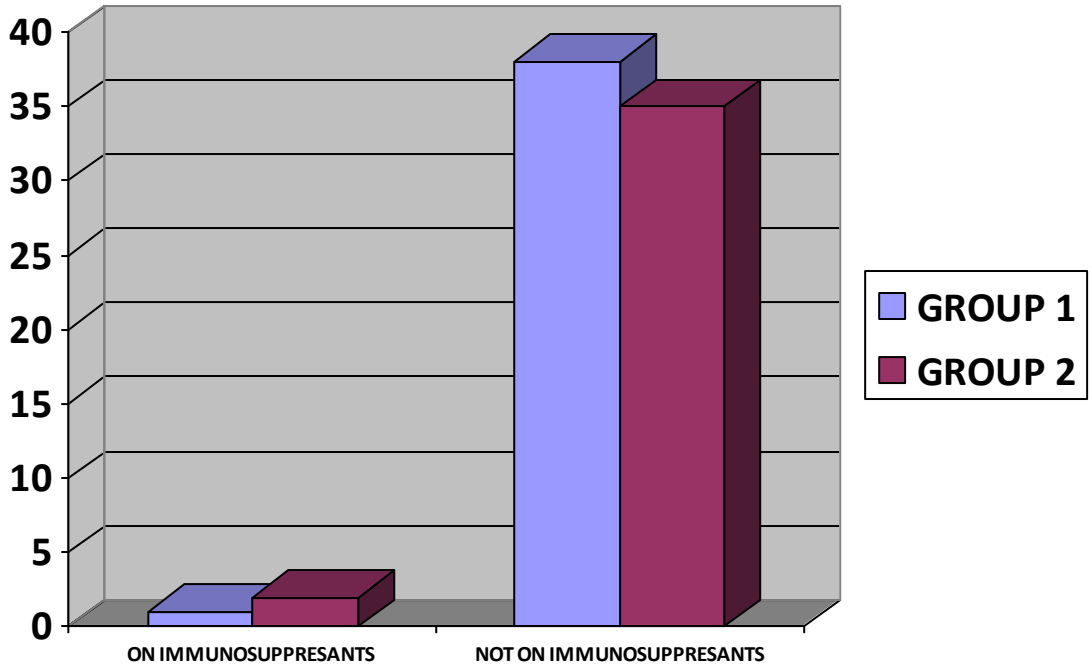


The above table shows that the mean duration of surgery was longer in Group 2. This may mean that the longer the duration of surgery, the more likely the patients were to develop hypothermia However in this study there was no statistically significant difference (p-value 0.755) between the 2 groups.

USE OF IMMUNOSUPPRESANTS

The following table shows the distribution of preoperative immunosuppressant use in the patients studied.

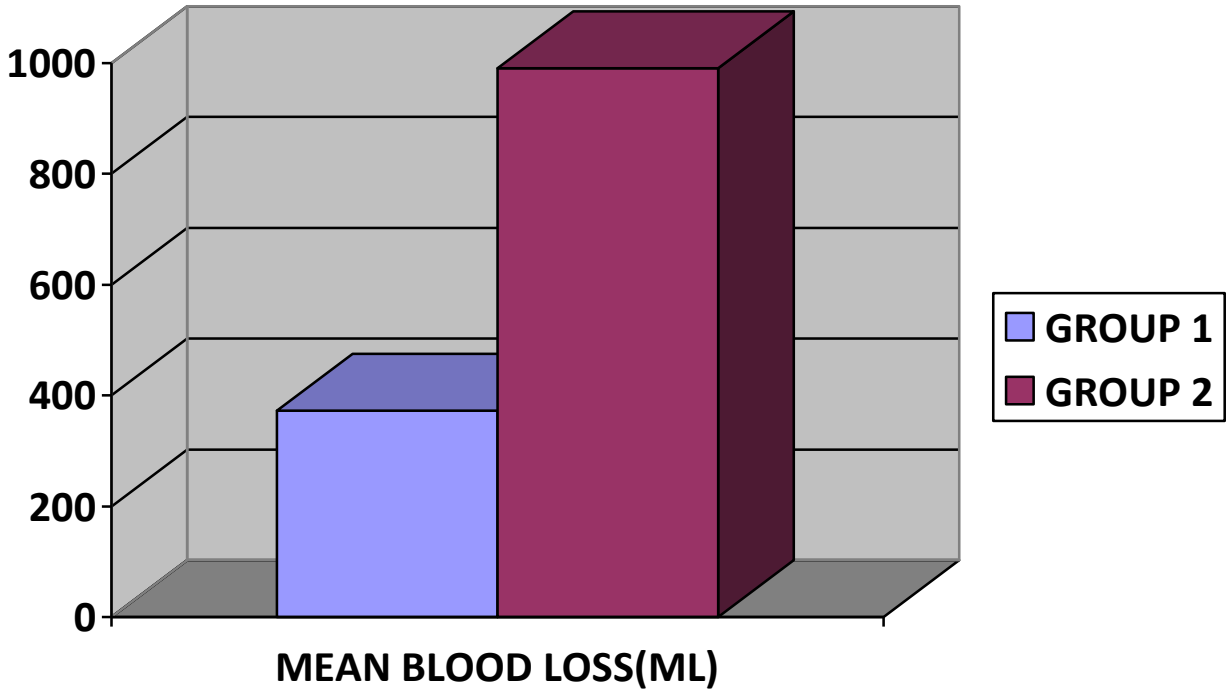
	ON IMMUNOSUPPRESANTS	NOT ON IMMUNOSUPPRESANTS
GROUP 1	1	38
GROUP 2	2	35



This graph depicts that the majority of patients in both the groups were not on immunosuppresants. Immunosuppresants may predispose a patient to surgical site infection and hence when the role of hypothermia in surgical site infection is being studied it is important to find out if immunosuppressant use may be a confounding factor.This study showed that there was no statistically significant difference between the 2 groups in the distribution of patients taking preoperative immunosuppresants and hence the 2 groups are comparable.

INTRAOPERATIVE BLOOD LOSS

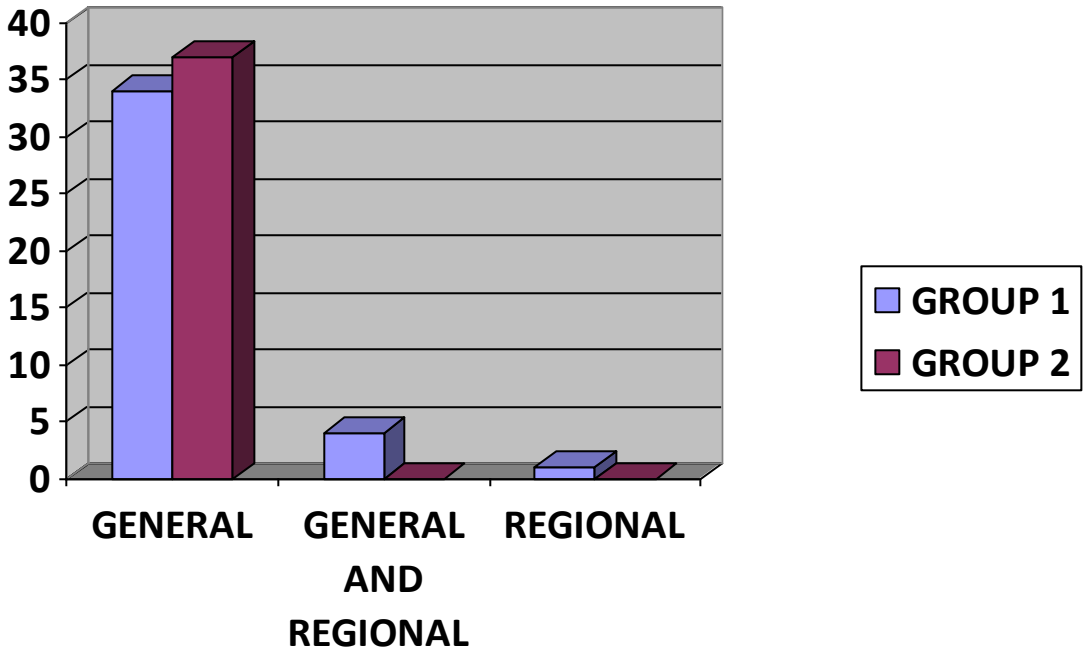
	MEAN BLOOD LOSS(ML)	STANDARD DEVIATION
GROUP 1	373	311.58
GROUP 2	991	1407.39



The mean blood loss is significantly higher in Group 2(p-value 0.009). We can surmise that since there was more blood loss in group 2, these patients were also probably more likely to require more intravenous fluids and blood or blood products . The infusion of unwarmed intravenous fluids and blood or blood products has been shown to contribute to intraoperative hypothermia.

TYPE OF ANAESTHESIA

	GENERAL	GENERAL AND REGIONAL	REGIONAL
GROUP 1	34(87.2%)	4(10.3%)	1(2.6%)
GROUP 2	37(100%)	0	0

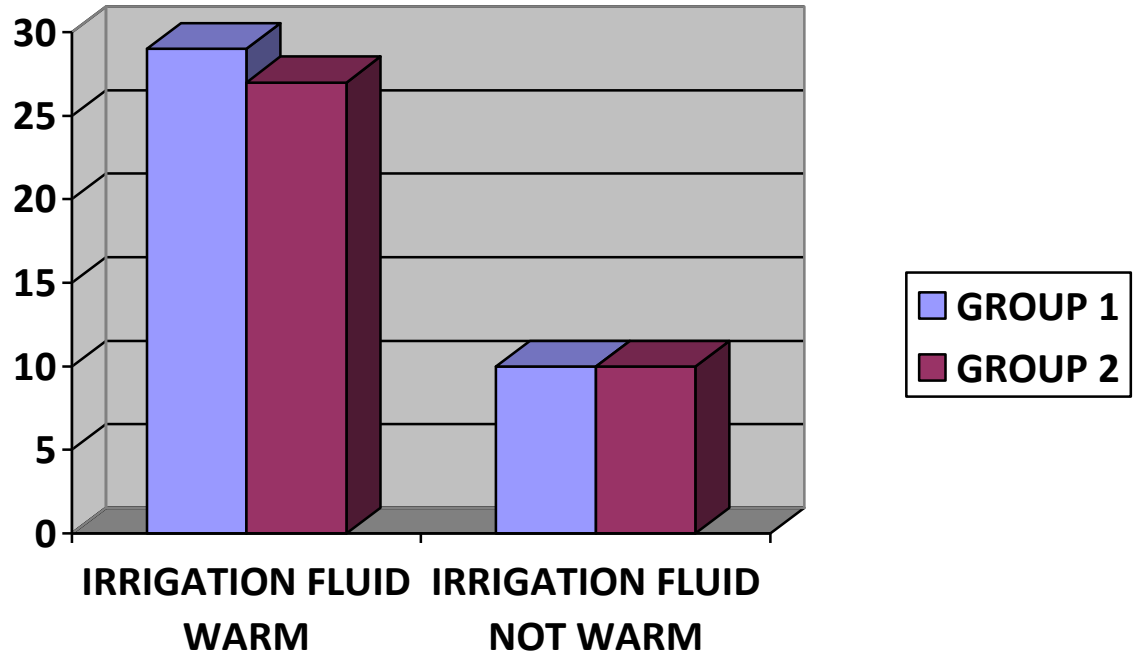


The majority of the patients in both groups underwent surgery under general anaesthesia. Patients under general as well as regional anaesthesia are more likely to develop intraoperative hypothermia but the comparison could not be made here since the number of patients in this category was too few in this study.

WARM IRRIGATION FLUIDS

The practise of using warm irrigation fluids during the operation has been shown to decrease the incidence of inadvertent intraoperative hypothermia. The data from this study is presented below.

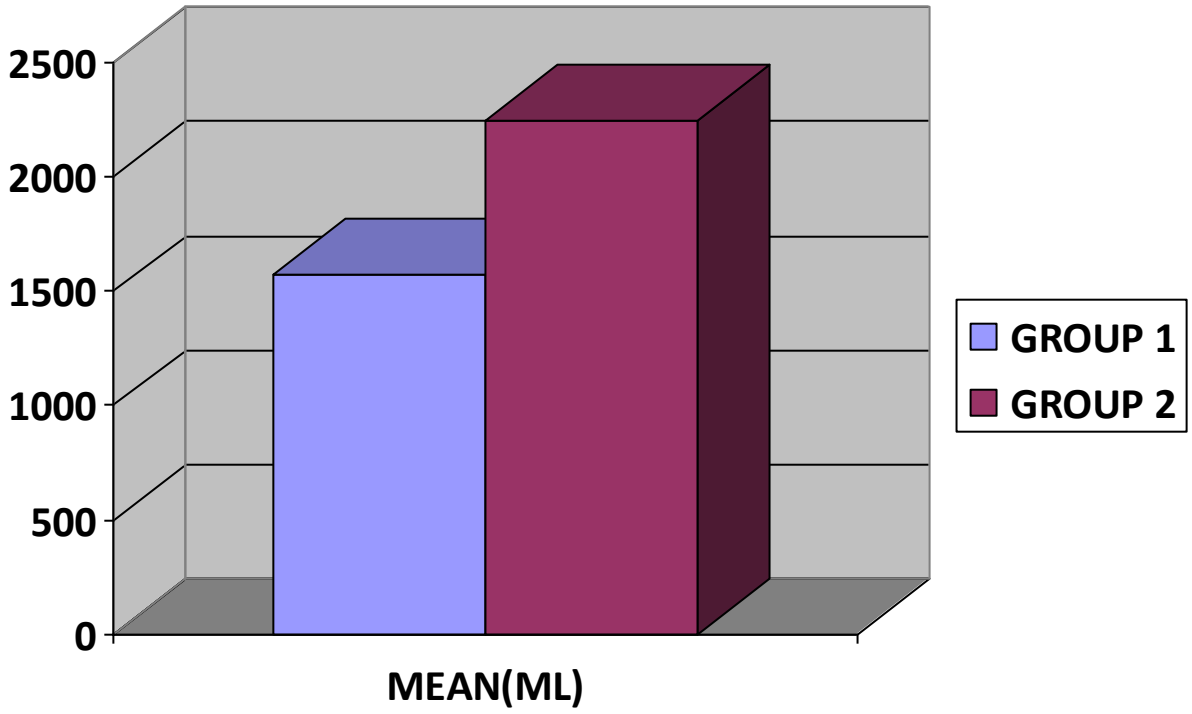
	IRRIGATION FLUID WARM	IRRIGATION FLUID NOT WARM
GROUP 1	29(74.4%)	10(25.6%)
GROUP 2	27(73%)	10(27%)



One of the practical problems faced in our operation theatre is the unavailability of warm fluids for surgery when operating time is after the regular hours. Due to the relative decrease in the number of staff working on the evening and night shifts ,sometimes getiing warm irrigation fluids is not practically possible.

TOTAL CRYSTALLOIDS USED INTRAOPERATIVELY

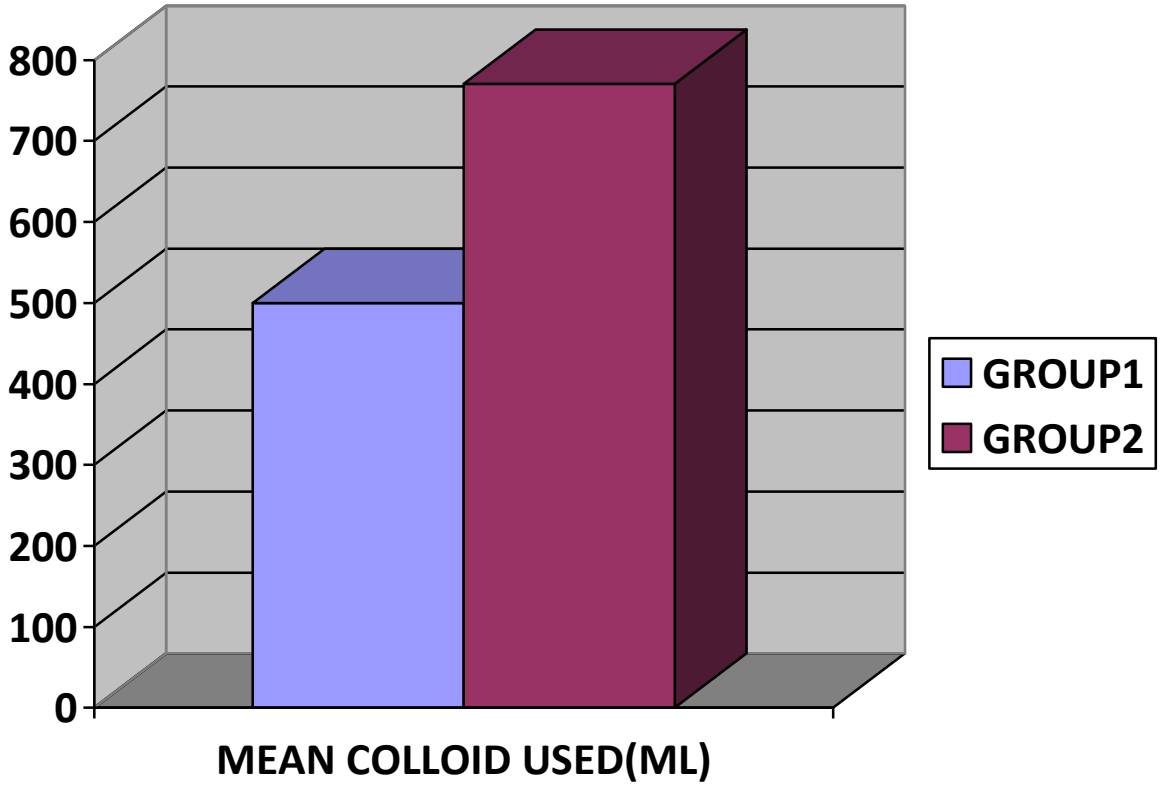
	MEAN CRYSTALLOID USED(ML)	STANDARD DEVIATION
GROUP 1	1573	311.58
GROUP 2	2243	1407.39



The independent t-test revealed a p-value of 0.007 on comparing the means between the 2 groups. Clinically also the total crystalloids used in Group 2 is significantly higher and may have contributed to the hypothermia.

TOTAL COLLOIDS USED

	MEAN COLLOID USED(ML)	STANDARD DEVIATION
GROUP1	500	303
GROUP2	770.2	324

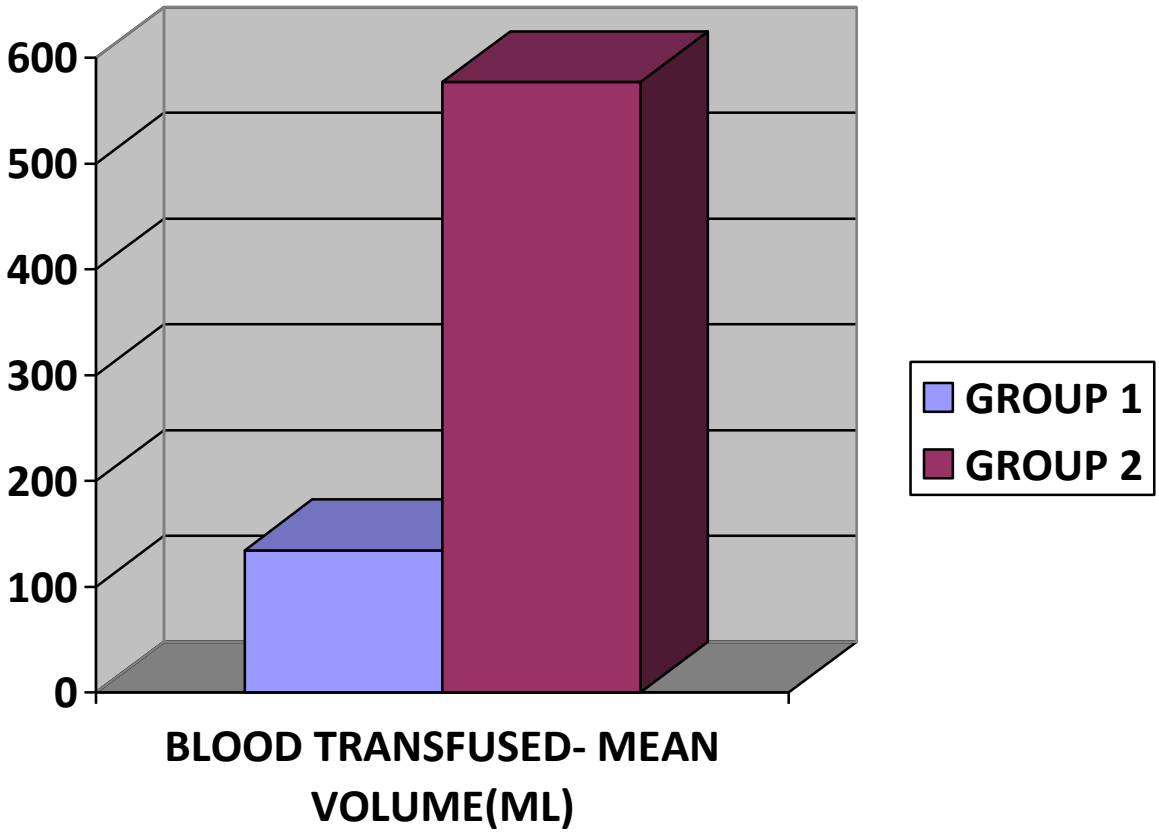


Using the independent t-test, the 2 means were compared and a p-value of 0.000 was obtained.

The difference in colloid usage between the 2 groups is also clinically significant .

TOTAL BLOOD TRANSFUSED INTRAOPERATIVELY

	BLOOD TRANSFUSED- MEAN VOLUME(ML)	STANDARD DEVIATION
GROUP 1	134.6	346
GROUP 2	577.03	1325



Since the data was in a skewed distribution, the Mann- Whitney test was used to compare the 2 groups. The p- value was found to be 0.013. The difference in the amount of blood transfused is also clinically significant . Group 2 , the delayed normalisers had more blood transfused intraoperatively and this probably contributed to lower core body temperatures intraoperatively.

AMOUNT OF BLOOD PRODUCTS TRANSFUSED INTRAOPERATIVELY

A) FRESH FROZEN PLASMA

	FFP TRANSFUSED-MEAN(ML)	STANDARD DEVIATION
GROUP 1	115.38	578
GROUP 2	283.78	931

The Mann- Whitney test was used to compared the mean FFP quantity used in the 2 groups, due to the skewed distribution. A p-value of 0.356 was obtained, which is not statistically significant.

B) PLATELET RICH CONCENTRATE

	PRC – MEAN(UNITS)	STANDARD DEVIATION
GROUP 1	**0**	**0**
GROUP 2	**0.865**	**3.00**

The Mann- Whitney test was used to compared the mean PRC quantity used in the 2 groups, due to the skewed distribution. A p-value of 0.072 was obtained, which is not statistically significant.

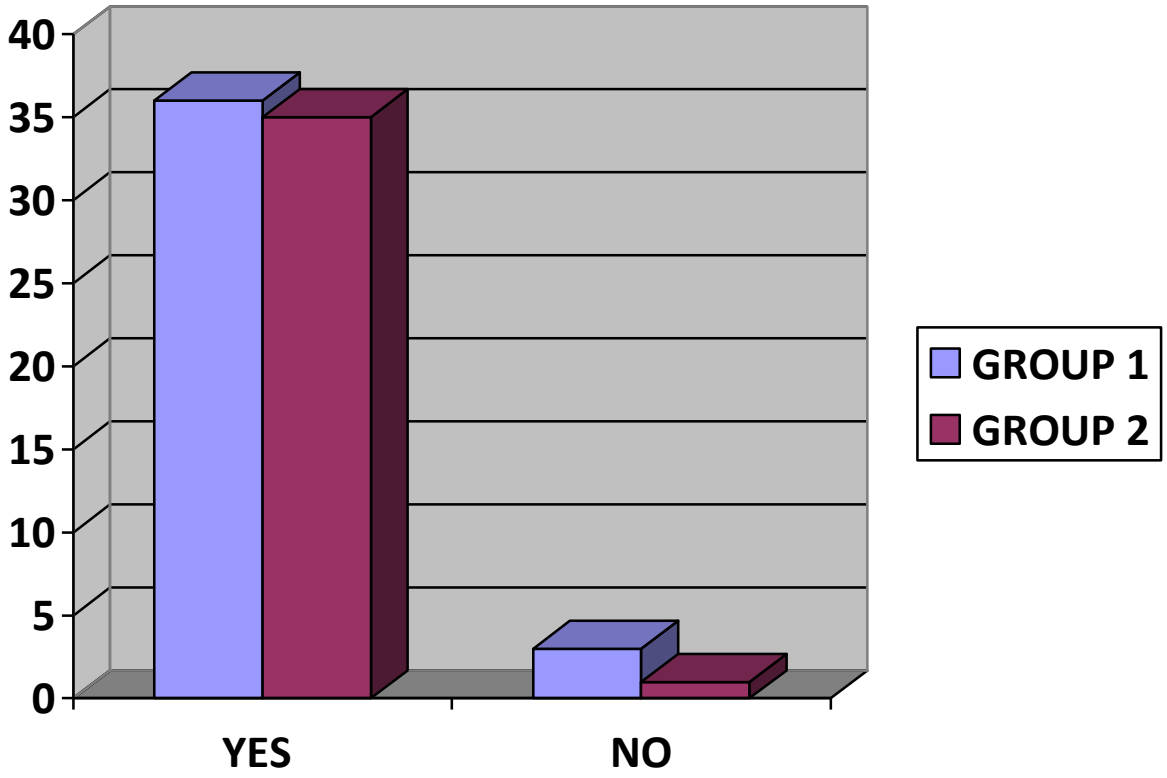
	CRYOPRECIPITATE-MEAN(UNITS)	STANDARD DEVIATION
GROUP 1	**0.512**	**3.20**
GROUP 2	**1.62**	**6.42**

The Mann- Whitney test was used to compared the mean cryoprecipitate quantity used in the 2 groups, due to the skewed distribution. A p-value of 0.356 was obtained, which is not statistically significant.

INTRAOPERATIVE TEMPERATURE MONITORING

The following table shows whether temperature monitoring was done intraoperatively or not for the patients.

	YES	NO
GROUP 1	36(92.3%)	3 (7.7%)
GROUP 2	35(94.6%)	1(2.7%)

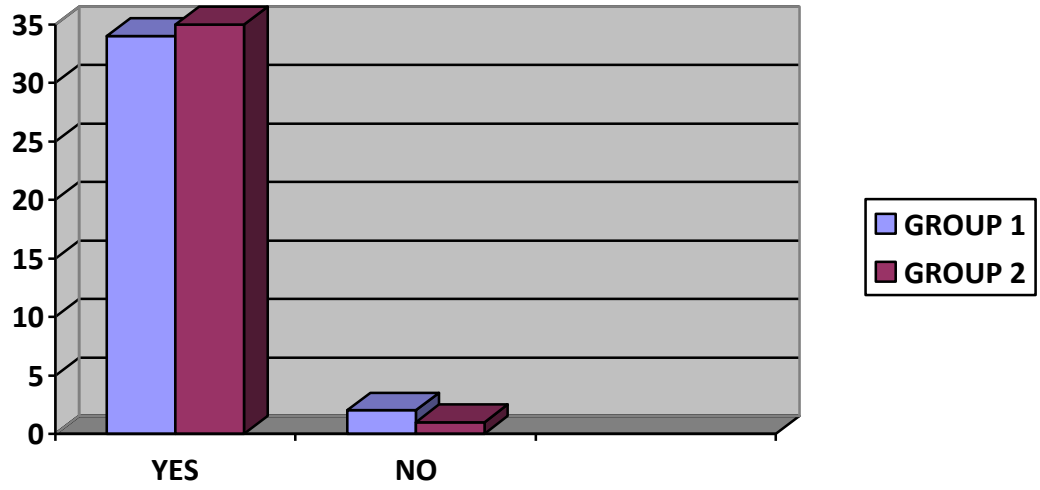


Chi- square test revealed a p-value of 0.330, which shows no significant difference in whether temperature was monitored or not between the 2 groups.

INTRAOPERATIVE HYPOTHERMIA

The following table shows the incidence of intraoperative hypothermia, defined as a core body temperature less than 36.5°C recorded intraoperatively in the anaesthesia record, if temperature was monitored intraoperatively.

	YES	NO	TOTAL
GROUP 1	34	2	36
GROUP 2	35	1	36

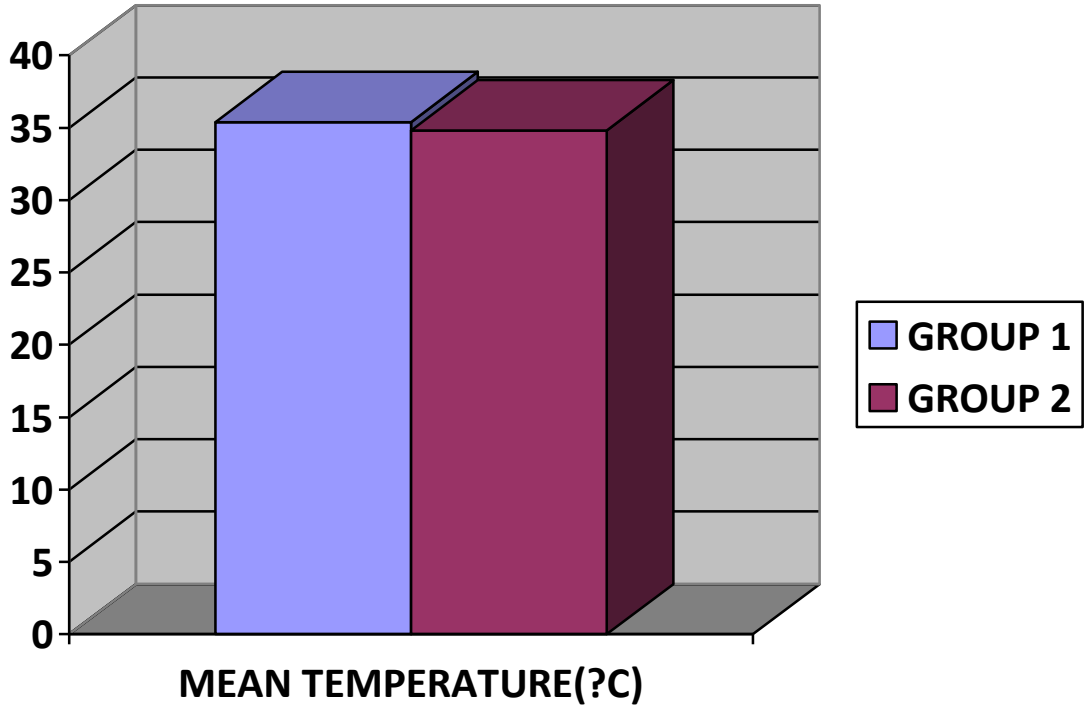


There was no siginificant difference between the 2 groups in the incidence of intraoperative hypothermia(p-value 0.443).The majority of patients in both groups had hypothermia intraoperatively as well. Only 3 patients overall were recorded to be normothermic intraoperatively but had inadvertent postoperative hypothermia ,which probably occurred at transfer.

LOWEST INTRAOPERATIVE TEMPERATURE

The following table compares the lowest temperatures recorded intraoperatively between the 2 groups.

	MEAN TEMPERATURE(°C)	STANDARD DEVIATION
GROUP 1	35.4	0.437
GROUP 2	34.8	0.879

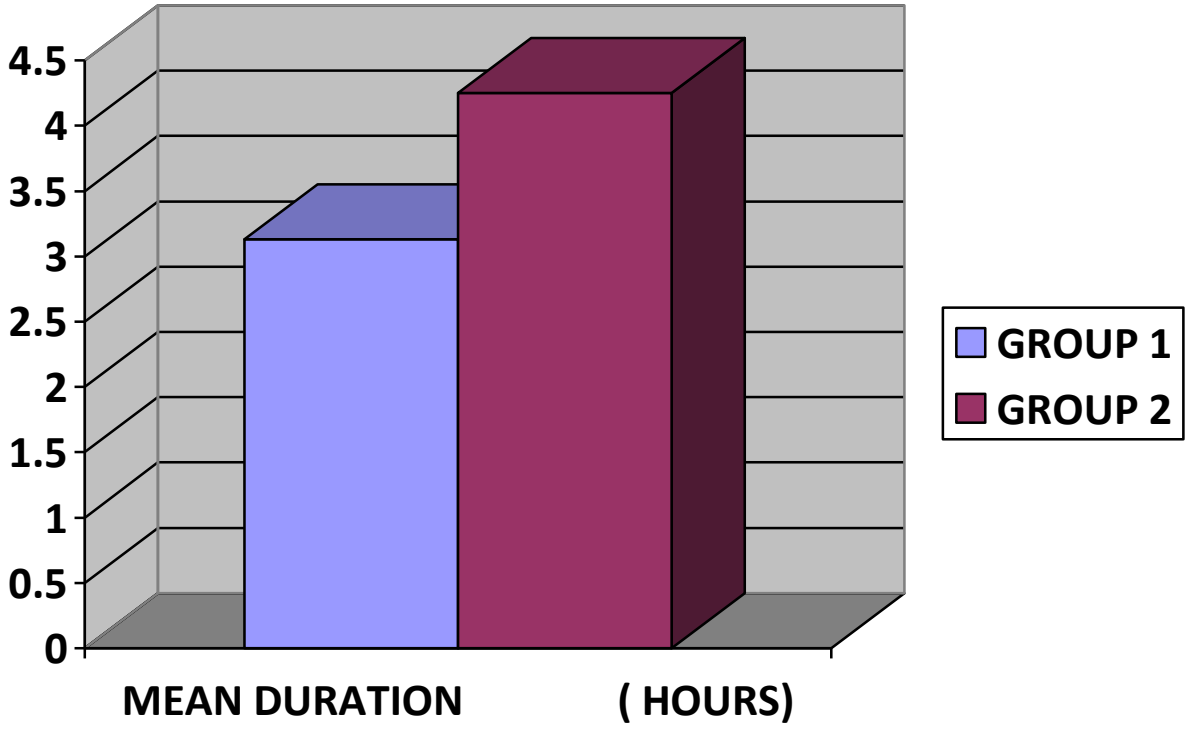


The independent t-test revealed a p-value of 0.001 on comparing the 2 groups which shows a statistically significant difference between the 2 groups. The delayed normalisers had a lower core body temperature intraoperatively as well.

DURATION OF INTRAOPERATIVE HYPOTHERMIA

The following table compares the mean duration of intraoperative hypothermia between the 2 groups of patients.

	MEAN DURATION (HOURS)	STANDARD DEVIATION
GROUP 1	3.13	2.04
GROUP 2	4.25	3.11



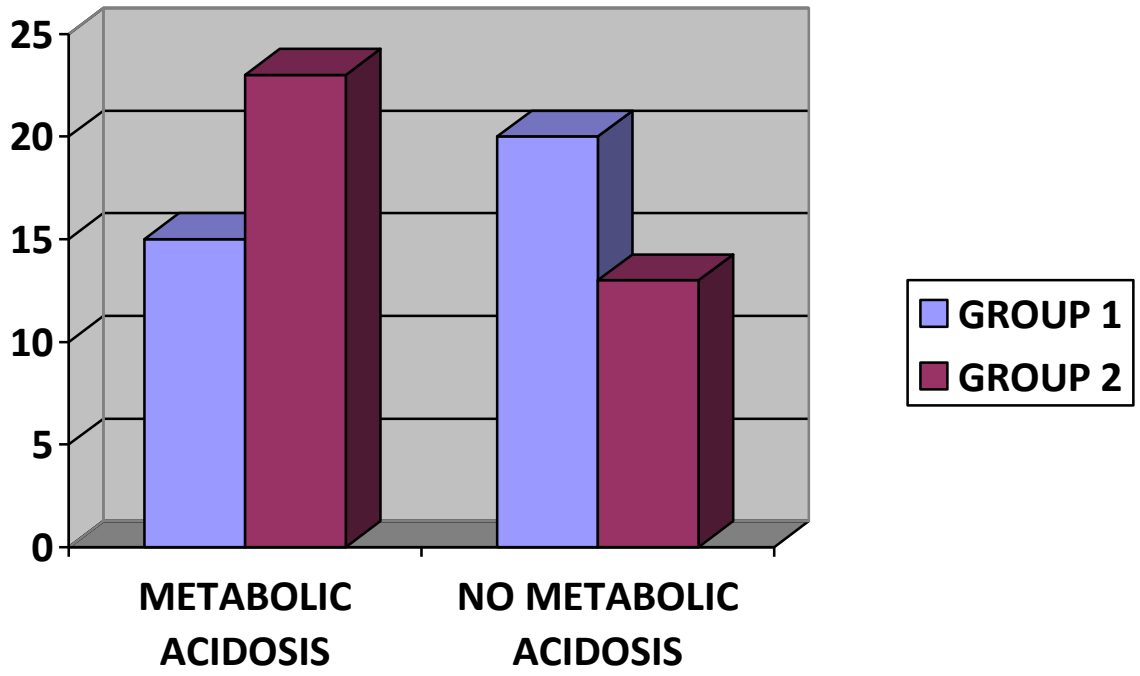
The mean duration of intraoperative hypothermia was significantly different between the 2 groups. Independent t-test revealed a p-value of 0.078. The delayed normalisers had a longer duration of intraoperative hypothermia as compared to the early normalisers.

INTRAOPERATIVE METABOLIC ACIDOSIS

35 out of 39 patients in group 1 had arterial blood gas analysis done intraoperatively while 36 out of 37 patients had it done in group 2 .

The following table shows the presence or absence of metabolic acidosis in the 2 groups.

	METABOLIC ACIDOSIS	NO METABOLIC ACIDOSIS	TOTAL
GROUP 1	15	20	35
GROUP 2	23	13	36

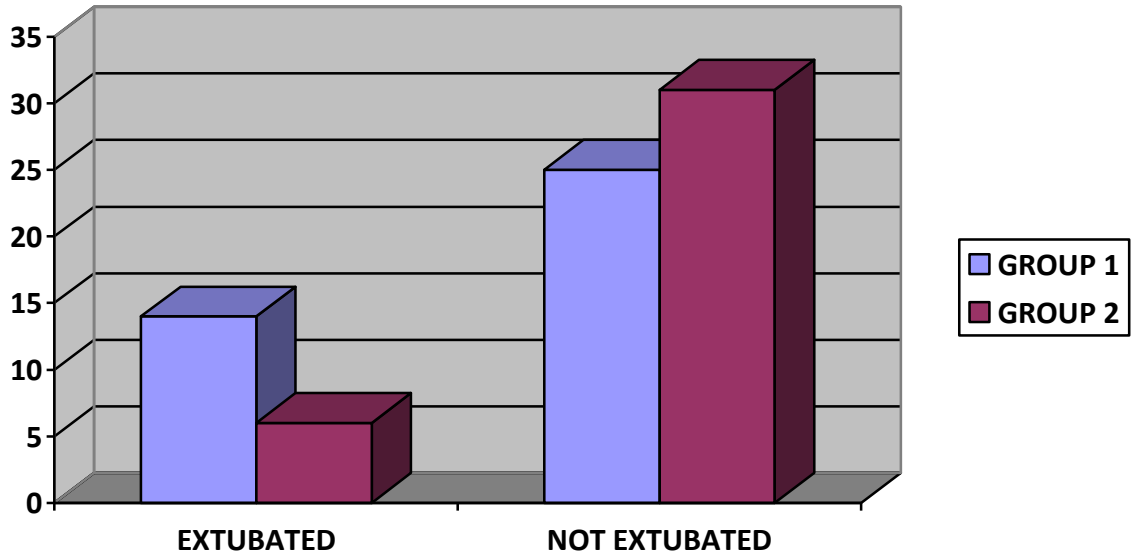


Comparing the 2 groups there was no statistically significant difference as the Chi-square test revealed a p-value of 0.085.

MECHANICAL VENTILATION ON ARRIVAL IN SICU

The following table shows the distribution of patients who were extubated or not extubated at the end of the surgery.

	EXTUBATED	NOT EXTUBATED
GROUP 1	14	25
GROUP 2	6	31

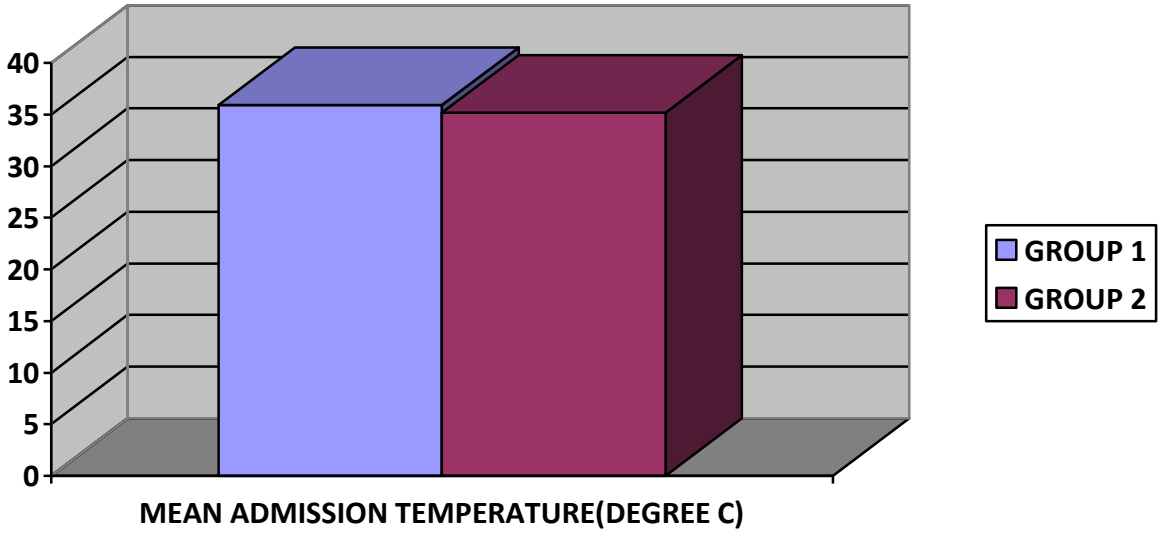


The Chi-square test revealed a p-value of 0.051 on comparing the 2 groups, which shows that there is no statistical difference between them. Since the intraoperative data was collected retrospectively it was difficult to ascertain if hypothermia was the main reason for continued postoperative mechanical ventilation in the patients studied.

TEMPERATURE ON ADMISSION IN S.I.C.U

The following table shows the mean admission nasopharyngeal temperature recorded in S.I.C.U immediately postoperatively.

	MEAN ADMISSION TEMPERATURE (° C)	STANDARD DEVIATION
GROUP 1	35.9	0.31
GROUP 2	35.2	0.61

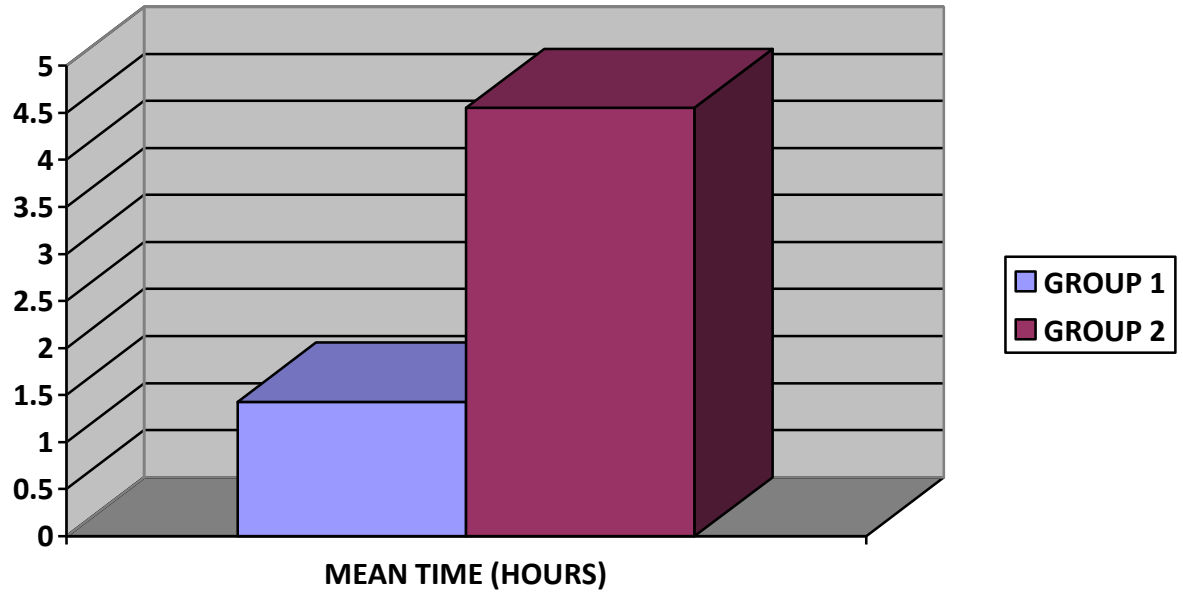


The independent t-test revealed a p-value of 0.00 which shows a statistically significant difference between the 2 groups. The delayed normalisers had a lower admission core temperature than the early normalisers and this probably contributed to them requiring a longer time to normalize their core body temperature.

TIME TO NORMALISATION OF TEMPERATURE

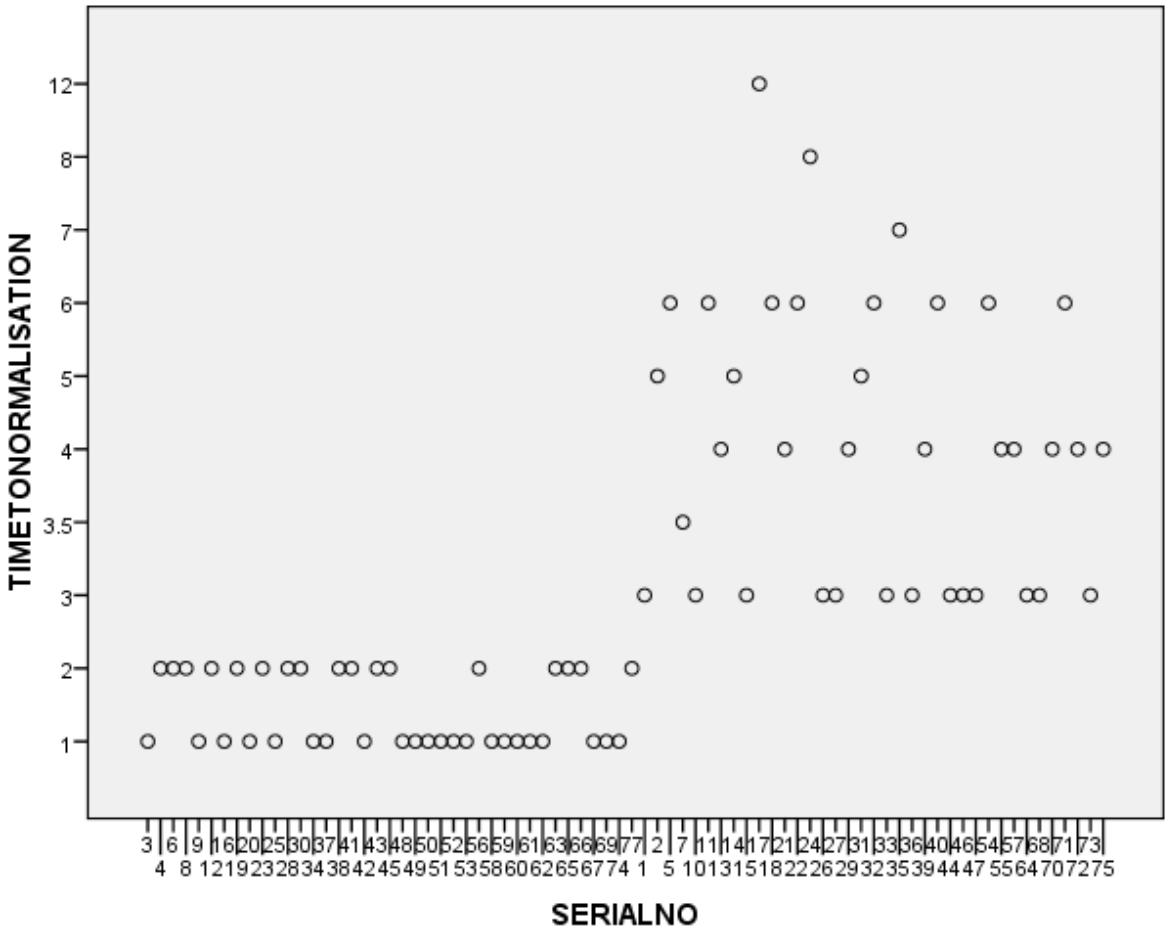
The following temperature shows the difference in the time to normalization of temperature between the 2 groups.

	MEAN TIME (HOURS)	STANDARD DEVIATION
GROUP 1	1.43	0.50
GROUP 2	4.55	1.87



There was a statistically significant difference in the time to normalization of temperature between the 2 groups(p- value 0.00) . The difference in time is also clinically significant.

The following scatter plot shows the distribution of the time to normalization of temperature among the patients studied.



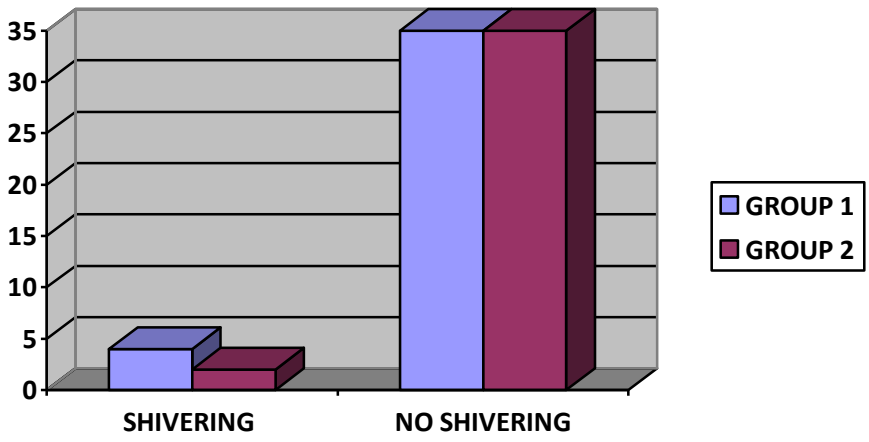
The following table shows the range of distribution of the time to normalization among the 2 groups.

	MINIMUM TIME(HOURS)	**MAXIMUM TIME(HOURS)**
GROUP 1	1	2
GROUP 2	3	12

POSTOPERATIVE SHIVERING

The following table shows the incidence of postoperative shivering among the 2 groups.

	SHIVERING	NO SHIVERING
GROUP 1	4	35
GROUP 2	2	35

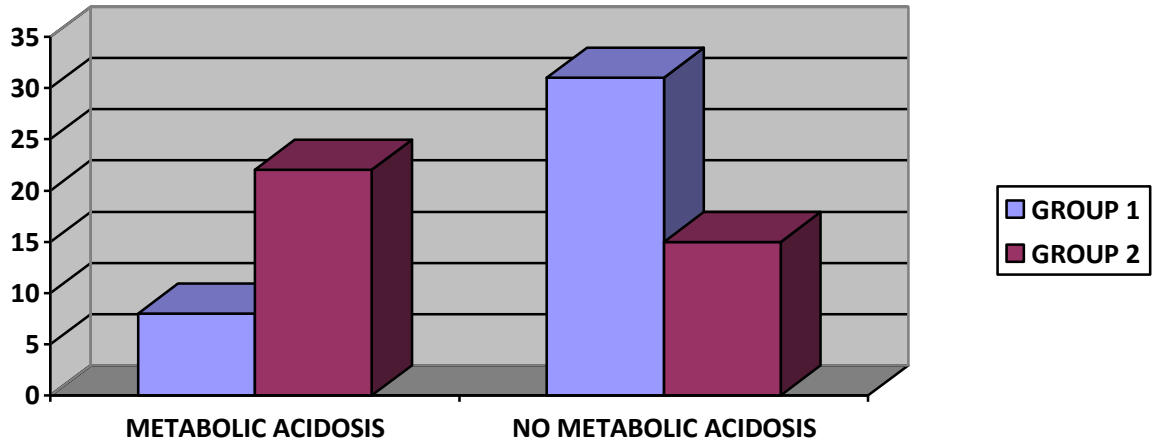


There was no significant difference in the incidence of shivering between the 2 groups(p-value 0.433).Postoperatively on arrival in the S.I.C.U all patients who are hypothermic are warmed with a forced warm air device using the prescribed sheets. Shivering is deleterious as it increases the oxygen consumption dramatically and may even precipitate a myocardial infarction due to a mismatch in the demand-supply ratio of oxygen to an already compromised myocardium. The longer patients remain hypothermic ,the longer their duration of shivering will be. Hence attaining normothermia at the earliest following inadvertent hypothermia may be advised.

METABOLIC ACIDOSIS

The following table shows the incidence of metabolic acidosis on arrival in SICU among the 2 groups.

	METABOLIC ACIDOSIS	NO METABOLIC ACIDOSIS
GROUP 1	8	31
GROUP 2	22	15

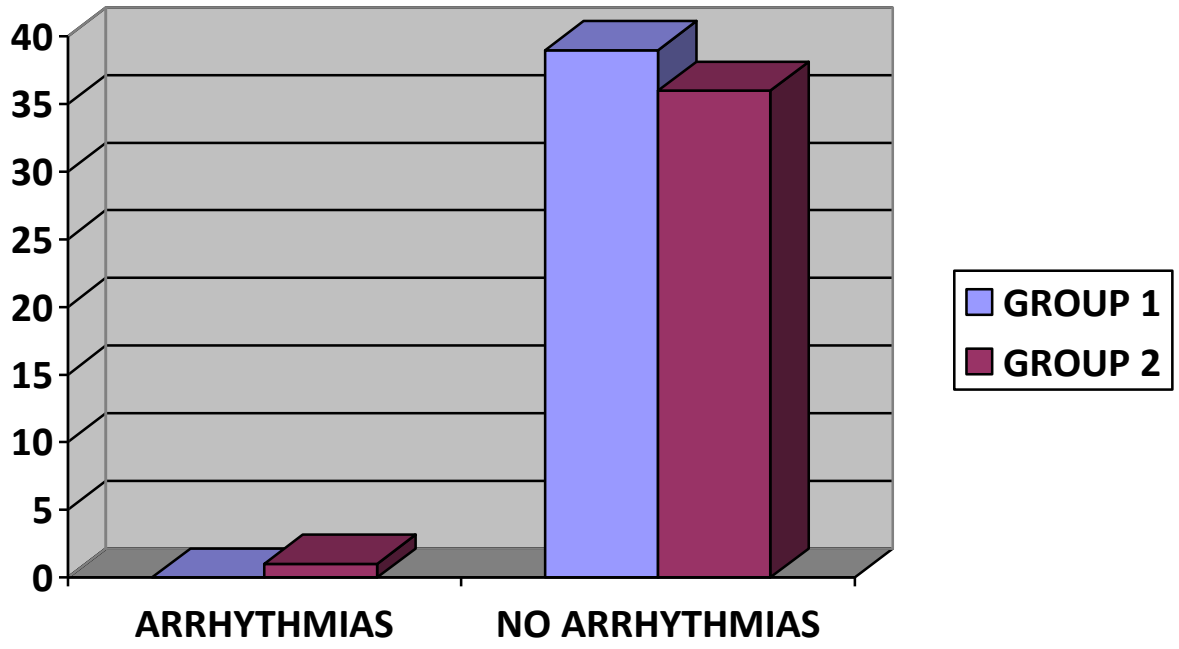


There was a significant difference between the 2 groups in the incidence of metabolic acidosis on arrival in the SICU(p-value 0.001). The delayed normalisers were more likely to have metabolic acidosis on arrival in the SICU. Hypothermia contributes to metabolic acidosis and since the delayed normalisers were earlier demonstrated to also have had a lower intraoperative core temperature, they were also probably more likely to have metabolic acidosis.

POSTOPERATIVE ARRHYTHMIAS

The following table shows the incidence of arrhythmias in the postoperative period.

	ARRHYTHMIAS	NO ARRHYTHMIAS
GROUP 1	0	39
GROUP 2	1	36



Hypothermia predisposes a patient to arrhythmias and the longer a patient remains hypothermic, we could hypothesise that the risk of arrhythmias increases. However this study failed to demonstrate a statistically significant difference between the 2 groups in the incidence of arrhythmias. Larger number of patients may need to be studied to demonstrate this as this complication has a low incidence .

SURGICAL SITE INFECTIONS(S S I)

Surgical site infections were defined using the CDC criteria as follows.

A superficial incisional SSI must meet the following criterion: Infection occurs within 30 days after the operative procedure and involves only skin and subcutaneous tissue of the incision and patient has at least 1 of the following:

a. purulent drainage from the superficial incision

b. organisms isolated from an aseptically obtained culture of fluid or tissue from the superficial incision

c. at least 1 of the following signs or symptoms of infection: pain or tenderness, localized swelling, redness, or heat, and superficial incision is deliberately opened by surgeon and is culture positive or not cultured. A culture-negative finding does not meet this criterion.

d. diagnosis of superficial incisional SSI by the surgeon or attending physician.

A deep incisional SSI must meet the following criterion:Infection occurs within 30 days after the operative procedure if no implant[1] is left in place or within 1 year if implant is in place and the infection appears to be related to the operative procedure and involves deep soft tissues (eg, fascial and muscle layers) of the incision and patient has at least 1 of the following:

a. purulent drainage from the deep incision but not from the organ/space component of the surgical site

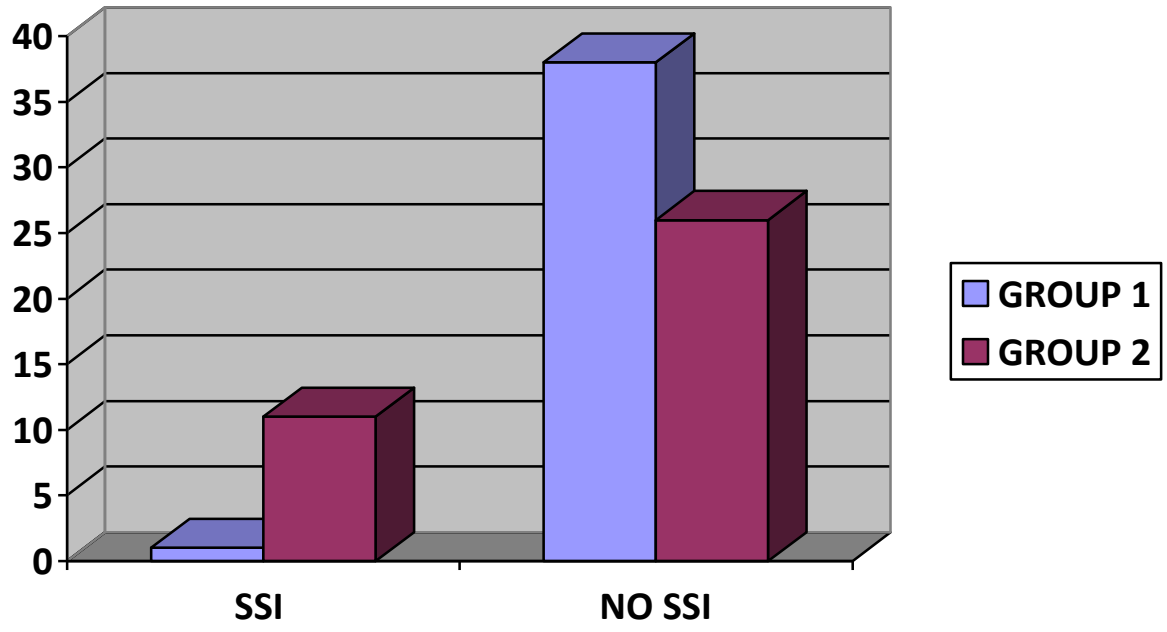
b. a deep incision spontaneously dehisces or is deliberately opened by a surgeon and is culture-positive or not cultured when the patient has at least 1 of the following signs or symptoms: fever (.388C), or localized pain or tenderness. A culture-negative finding does not meet this criterion.

c. an abscess or other evidence of infection involving the deep incision is found on direct examination, during reoperation, or by histopathologic or radiologic examination

d. diagnosis of a deep incisional SSI by a surgeon or attending physician.

The following table shows the incidence of surgical site infections, inclusive of superficial and deep, among the 2 groups.

	SSI	NO SSI
GROUP 1	1	38
GROUP 2	11	26

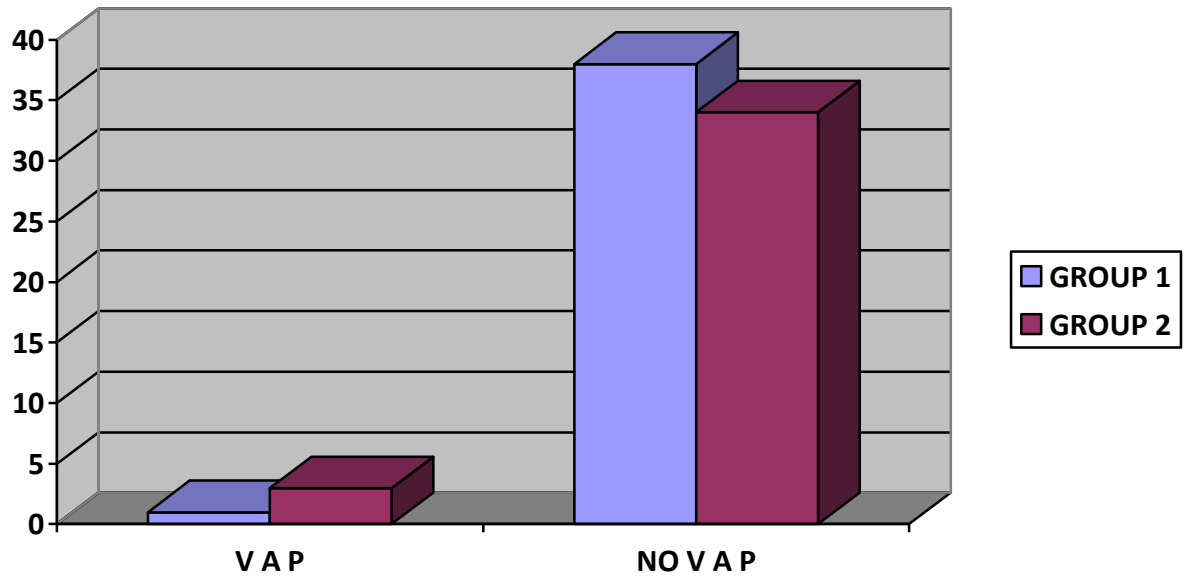


There was a statistically significant difference in the incidence of surgical site infections between the 2 groups(p-value 0.001). The delayed normalisers were more likely to develop a surgical site infection than the early normalisers. Hypothermia has been shown to impair immunity and the longer a patient remains hypothermia the longer the immunity is impaired and this translates into an increased incidence of surgical site infections in the delayed normalisers.

VENTILATOR ASSOCIATED PNEUMONIA(V A P)

The following table shows the incidence of ventilator associated pneumonia in the 2 groups.

	V A P	NO V A P
GROUP 1	1	38
GROUP 2	3	34

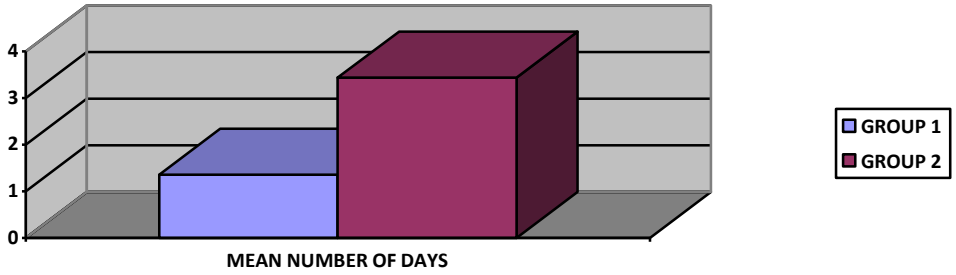


There was no statistically significant difference in the incidence of ventilator associated pneumonias between the 2 groups(p- value 0.279)

MECHANICAL VENTILATION

The following table shows the mean number of days the patients in each group required mechanical ventilation.

	MEAN NUMBER OF DAYS	STANDARD DEVIATION
GROUP 1	1.359	1.87
GROUP 2	3.432	4.33

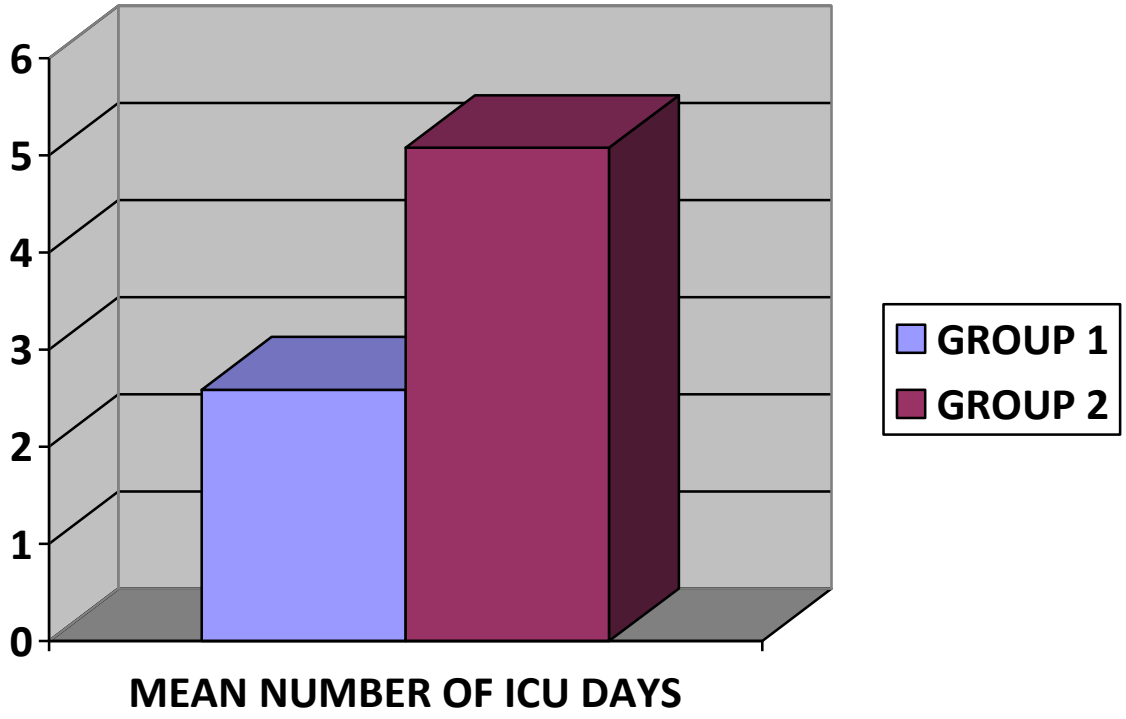


There was a statistically significant difference in the number of days of mechanical ventilation between the 2 groups(p-value 0.008). The delayed normalisers were ventilated for more number of days than the early normalisers. Other confounding factors may have played a role in this but they may have also contributed to these patients having taken longer to normalize their temperature. This difference in days is also clinically significant . Each day of mechanical ventilation comes with the risks of ventilator associated pneumonia and other complications. We must therefore strive to prevent inadvertent intraoperative hypothermia and also try and minimize the duration to normalization once hypothermia has been detected.

DURATION OF ICU STAY

The following table shows the mean duration of ICU stay in the 2 groups.

	MEAN NUMBER OF ICU DAYS	STANDARD DEVIATION
GROUP 1	2.589	1.88
GROUP 2	5.081	4.56

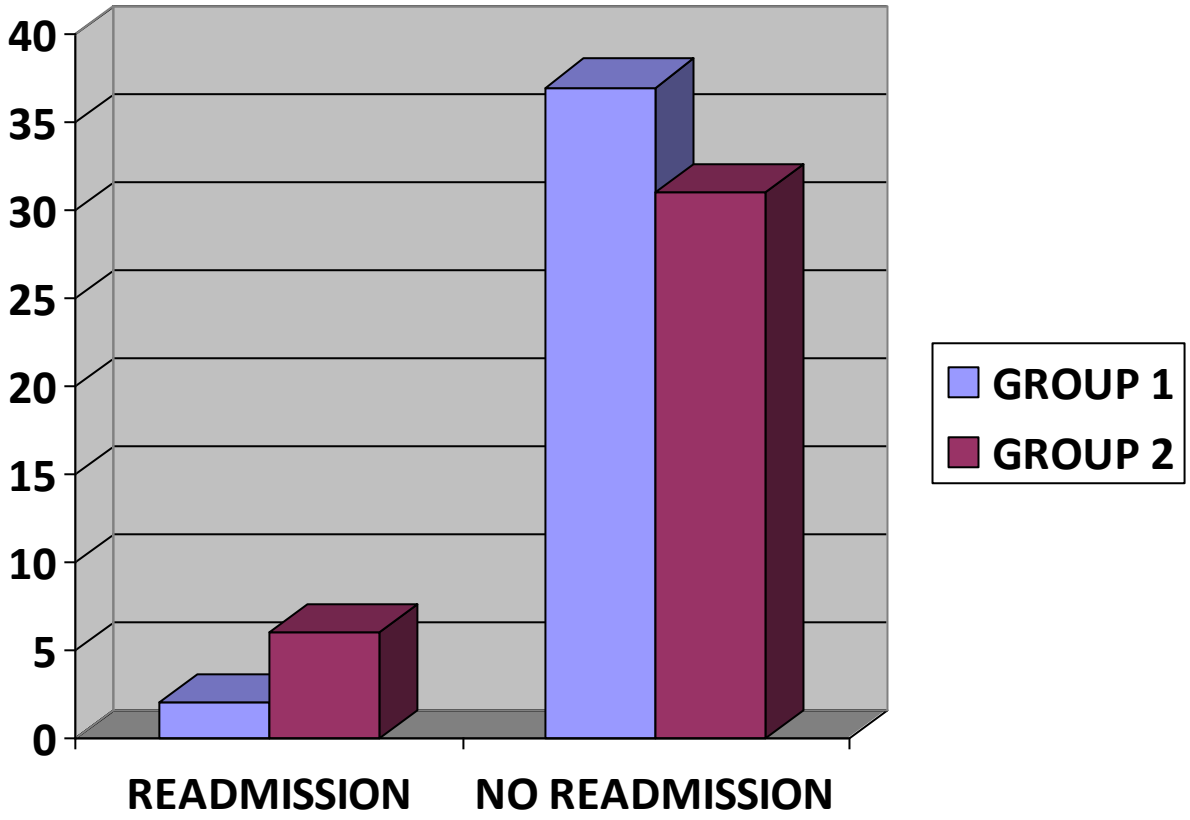


There was a statistically significant difference in the number of ICU days between the 2 groups(p-value 0.002). The delayed normalisers needed atleast 3 more number of days in the intensive care unit than the early normalisers.The difference in days is also clinically very significant. One day in SICU may cost a minimum of Rs 5000 and this economic burden is significant for our population.

READMISSION TO SICU

The following table shows the incidence of readmission to the surgical intensive care unit (SICU) in the 2 groups of patients.

	READMISSION	NO READMISSION
GROUP 1	2	37
GROUP 2	6	31

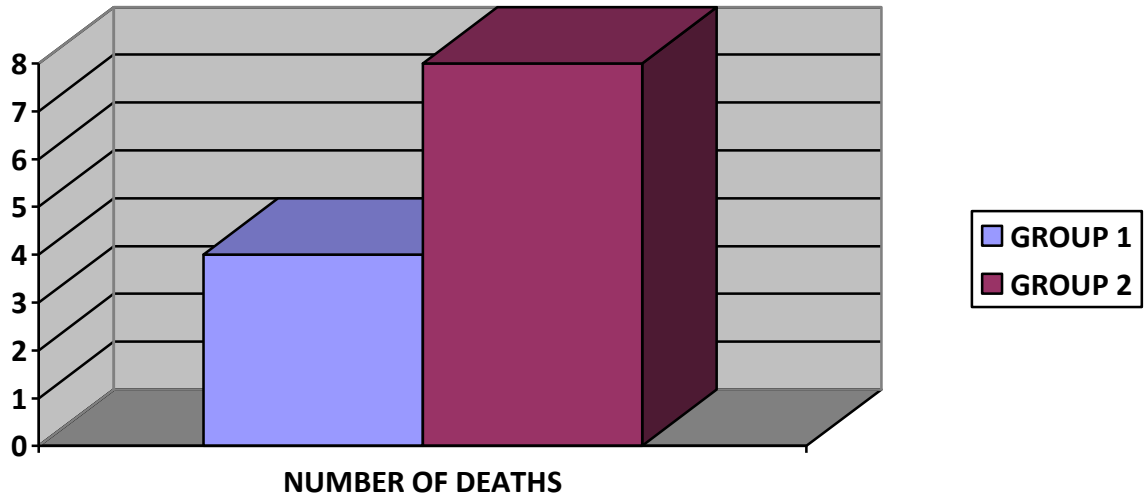


There was no statistical difference in the incidence of readmission to the SICU among the 2 groups(p-value 0.115).

DEATH

The following table compares the number of deaths in the 2 groups.

	NUMBER OF DEATHS	TOTAL PATIENTS
GROUP 1	4	39
GROUP 2	8	37



There was no statistically significant difference in the number of deaths in the 2 groups (p-value 0.174). Larger number of patients may need to be studied however to conclude if there is an increased incidence in delayed normalisers.

TIME TO NORMALISATION OF TEMPERATURE IS AN INDEPENDENT PREDICTOR OF INCREASED RISK OF SURGICAL SITE INFECTIONS

The APACHE II score , amount of crystalloids ,colloids ,blood and blood products that were transfused ,blood loss during surgery and the duration of surgery were significantly different between the 2 groups and this may have contributed to the adverse outcomes in the delayed normalisers. Hence logistic regression analysis was done to adjust for these factors.

	p-value	ODDS RATIO	95% C.I FOR ODDS RATIO	
			LOWER	UPPER
SURGICAL SITE INFECTION	0.016	18.75	1.743	200.862
APACHE II SCORE	0.012	1.20	1.042	1.385
TOTAL COLLOIDS	0.024	1.003	1.000	1.006
TOTAL CRYSTALLOIDS	0.412	1.000	0.999	1.001
BLOOD TRANSFUSED	0.255	1.001	0.999	1.004
BLOOD LOSS	0.835	1.000	0.998	1.002
DURATION OF SURGERY	0.061	1.000	1.000	1.000

After adjusting for the other factors listed above that may have contributed to the primary outcome, the time to normalization of temperature was still shown to be a significant contributing factor to the development of surgical site infections(p-value 0.016). An odds ratio of 18.75 was found, indicating that the delayed normalisers were 18.75 times more likely to develop a surgical site infection than the early normalisers. This finding is also clinically very significant.

DISCUSSION

Inadvertent perioperative hypothermia, defined as core body temperature ≤36.5°C in this study , is a common consequence of anaesthesia. Its adverse effects are well known to anaesthetists and include greater intraoperative blood loss and consequent blood transfusion(31). After the operation, inadvertent perioperative hypothermia can lead to an increased rate of wound infection(27), morbid cardiac events (30), and pressure sores and also a longer stay in both recovery and hospital (27) These are apart from the subjective discomfort and wound pain which cold and shivering may cause the patient. Significantly, maintaining normothermia perioperatively can modify these adverse effects. Mild perioperative hypothermia,which is common during major surgery, may promote surgical-wound infection by triggering thermoregulatory vasoconstriction,which decreases subcutaneous oxygen tension. Reduced levels of oxygen in tissue impair oxidative killing by neutrophils and decrease the strength of the healing wound by reducing the deposition of collagen (27).

Hypothermia also directly impairs immune function. Temperature is monitored routinely in critically ill patients. Nasopharyngeal temperature has been shown to be a close correlate to the core temperature as measured by a thermistor in the pulmonary artery catheter. Various factors contribute to perioperative hypothermia including cold operating rooms,intravenous administration of blood and IV fluids and exposure of body cavities for long hours of surgery. Thus the deleterious effects of perioperative hypothermia had been studied but whether the time taken for normalization of temperature specifically has an impact on the outcome of the patient has however not been previously studied.

The main objective of this study was to ascertain if there was also a relationship between the duration of normalization of this hypothermia and outcome. The primary outcome was the incidence of surgical site infections .The delayed normalisers were found to have a significant increase in the incidence of surgical site infections(42.3%) as compared to the early normalisers(2.6%). They also had more number of days needing mechanical ventilation and a longer duration of stay in the SICU. The incidence of arrhythmias ,coagulopathy, incidence of ventilator associated pneumonias and death was not statistically significantly different between the 2 groups.

A higher requirement of intraoperative crystalloids,colloids,blood and blood products and a longer duration of intraoperative hypothermia was associated with a delayed time to normalize temperature.In this study we could not demonstrate if the lack of temperature monitoring intraoperatively contributed to the time to normalization- larger number of patients may be required to demonstrate if there is an association.

Adjusting for factors that might have contributed to the development of surgical site infections,logistic regression showed that delayed normalization was still a significant factor (odds ratio 18.75,p-value 0.016)

CONCLUSION

Inadvertent intraoperative hypothermia has been shown to have many deleterious effects such as impaired coagulation, delayed wound healing,increased incidence of surgical site infection, cardiac arrhythmias,shivering and prolonged ICU stay.The main objective of this study was to ascertain if there was also a relationship between the duration of normalization of this hypothermia and outcome. The primary outcome was the incidence of surgical site infections .The delayed normalisers were found to have a significant increase in the incidence of surgical site infections as compared to the early normalisers(odds ratio 18.75,p-value 0.016). They also had more number of days needing mechanical ventilation and a longer duration of stay in the SICU and this difference was clinically as well as statistically significant. The incidence of arrhythmias ,coagulopathy, incidence of ventilator associated pneumonias and death was not statistically significantly different between the 2 groups.

A higher requirement of intraoperative crystalloids,colloids,blood and blood products and a longer duration of intraoperative hypothermia was associated with a delayed time to normalize temperature.In this study we could not demonstrate if the lack of temperature monitoring intraoperatively contributed to the time to normalization- larger number of patients may be required to demonstrate if there is an association.

We can thus conclude that all efforts should be made to prevent inadvertent intraoperative hypothermia . Anaesthetists and critical care physicians must be aware of the deleterious consequences of inadvertent hypothermia and warming must be done actively preoperatively,intraoperatively as well as in the postoperative period . The NICE guidelines give us simple ways in which to avoid inadvertent perioperative hypothermia and effort must be made

to adhere to them.The time to normalization of temperature does have a significant impact on the postoperative outcome and more studies may be required in this avenue.

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LIMITATIONS

The preoperative and intraoperative details were collected retrospectively from the anaesthesia record.Data regarding intraoperative temperature monitoring may not have been documented adequately in some cases.The mode of patient warming ,if it was done at all, was also not uniformly documented in the anaesthesia records and could not be analysed. One important factor influencing wound healing - preoperative albumin ,was not available for all patients as a large number of them underwent surgery on emergency basis. Albumin is also an acute phase reactant and may have been falsely low in this situation. Another factor that may increase the risk of wound infection is diabetes mellitus and the assocation could not be demonstrated in the small sample size in this study(only 10 out of 76 patients had a preoperative diagnosis of diabetes mellitus).The diagnosis of wound infection was done by the treating surgeon and this may have led to inter-observer variability although the CDC criteria was used. In future, studies which avoid these limitations may be planned in order to probe further into the association between the time to normalisation of temperature and postoperative outcome.

ANNEXURE-1

Data collection form
Serial number:
Patient name: Hospital number:
Sex:Male/female
Age:
APACHE II score: ICU admission on:

Circle primary reason for ICU admission:

Postoperative ventilation	Hemodynamic support	Monitoring	Hypothermia	Others -mention

Diagnosis:

Operation done:

Anaesthesia:

Duration of surgery:

Comorbidities

Diabetes mellitus	Hypertension	Hyperlipidemia	IHD
PVD	Prev.CVA	COPD	Other resp ds
Smoker	ex-smoker	Chronic liver disease	Chronic renal failure
Valvular heart disease	Endocrine (specify)	Hematological	

Medicines

Immunosuppressants ? Yes/No

INTRA OP
Blood loss:
Was irrigation fluid warm? Yes/No
Total crystalloids (ml):
Total colloids(ml):
Blood(ml):
PRC(units):
FFP(ml):
Cryoppt:
Was temperature monitored ? Yes /No
Hypothermia(<36 degrees Celsius)intra operatively?: Yes/No

Lowest temperature recorded:
Duration of intraoperative hypothermia(hrs):
Hypotension: Yes/No
If yes please state any obvious contributing factor:
New onset intra-op arrhythmias:
ABG done ? yes/no
Metabolic acidosis? Yes/No
Extubated? Yes /no
Delayed awakening? yes/no
If not extubated ,why?

TIME	ADMISSION	AFTER NORMALISATION
FIO2		
pH		
pA02		
pACO2		
HCO3-		
BE		
LACTATE		
SPO2		
HB		
Na		
K		
Cl		
Ca		

COURSE IN ICU
Admission temperature:
Time for temperature to normalise(>36degree C):
Shivering: Yes/ No
Metabolic acidosis: Yes/ No
Arrhythmias: Yes/ No
Surgical site infection: Yes/No
Ventilator associated pneumonia: Yes/No
Sepsis: Yes/ No
Likely source of sepsis:
Coagulopathy: Yes/ No
Ventilated days:
Decision to discharge from SICU on:
Number of SICU days:
Discharge from hospital:
Re-admission to SICU(and reason):
Death:
Total hospital bill:

ANNEXURE 2- INFORMED CONSENT

Some patients have a low body temperature following major surgery. This increases the risk of infection, bleeding, shivering and irregularities in the heart rhythm. All patients are warmed on arrival in the intensive care unit and their surface body temperature is monitored at regular intervals using a mercury thermometer. This study aims to find out if the time it takes for the body temperature to normalize has an impact on the patient's outcome. A thin wire-like temperature probe will be inserted through the patient's nostril to measure the core body temperature continuously until it becomes normal.This usually takes about 1-5 hours. This will allow us to measure the inner body temperature more accurately .The patient may have mild discomfort and there is a small chance of mild bleeding from the nose which is self-limited. There will be no difference in the treatment that the patient receives due to him/her being included in this study.There will be no extra cost charged to the patient as a consequence of participating in the study. Participation is voluntary and you may withdraw from the study at any time and this will not involve any loss of benefit to the patient. Patient confidentiality will be maintained.

Format of informed consent form for Subjects

Informed Consent form to participate in a research study

Study Title:

Study Number:

Subject's Initials: _____ Subject's Name: _____

Date of Birth / Age:_____

Please initial box

(Subject)

(i) I confirm that I have read and understood the information sheet dated _____ for the above study and have had the opportunity to ask questions.

(ii) I understand that my participation in the study is voluntary and that I am

free to withdraw at any time, without giving any reason, without my medical care or legal rights being affected. [ ]

(iii) I understand that the Sponsor of the clinical trial, others working on the Sponsor's behalf, the Ethics Committee and the regulatory authorities will not need my permission to look at my health records both in respect of the current study and any further research that may be conducted in relation to it, even if I withdraw from the trial. I agree to this access. However, I understand that my identity will not be revealed in any information released to third parties or published.

(iv) I agree not to restrict the use of any data or results that arise from this study provided such a use is only for scientific purpose(s)

(v) I agree to take part in the above study.

Signature (or Thumb impression) of the Subject/Legally Acceptable Representative:_____

Date: _____/_____/_____

Signatory's Name: _____

Signature of the Investigator: _____

Date: _____/_____/_____

Study Investigator's Name: _____

Signature of the Witness: _____

Date:_____/_____/_____

Name of the Witness: _____

ANNEXURE 3-APACHE 2 SCORING SYSTEM

Physiologic Variable	High Abnormal Range					Low Abnormal Range				
	+4	+3	+2	+1	0	+1	+2	+3	+4	Points
Temperature - rectal (°C)	≥41°	39 to 40.9°		38.5 to 38.9°	36 to 38.4°	34 to 35.9°	32 to 33.9°	30 to 31.9°	≤29.9°	
Mean Arterial Pressure - mm Hg	≥160	130 to 159	110 to 129		70 to 109		50 to 69		≤49	
Heart Rate (ventricular response)	≥180	140 to 179	110 to 139		70 to 109		55 to 69	40 to 54	≤39	
Respiratory Rate (non-ventilated or ventilated)	≥50	35 to 49		25 to 34	12 to 24	10 to 11	6 to 9		≤5	
Oxygenation: A-aDO2 **or** PaO2 (mm Hg) a. FIO2 ≥0.5 record A-aDO2 b. FIO2 <0.5 record PaO2	≥500	350 to 499	200 to 349		<200 PO2>70	 PO2 61 to 70		 PO2 55 to 60	 PO2<55	
Arterial pH (preferred) Serum HCO3 (venous mEq/l) (not preferred, but may use if no ABGs)	≥7.7 ≥52	7.6 to 7.69 41 to 51.9		7.5 to 7.59 32 to 40.9	7.33 to 7.49 22 to 31.9		7.25 to 7.32 18 to 21.9	7.15 to 7.24 15 to 17.9	<7.15 <15	
Serum Sodium (mEq/l)	≥180	160 to 179	155 to 159	150 to 154	130 to 149		120 to 129	111 to 119	≤110	
Serum Potassium (mEq/l)	≥7	6 to 6.9		5.5 to 5.9	3.5 to 5.4	3 to 3.4	2.5 to 2.9		<2.5	
Serum Creatinine (mg/dl) Double point score for acute renal failure	≥3.5	2 to 3.4	1.5 to 1.9		0.6 to 1.4		<0.6			
Hematocrit (%)	≥60		50 to 59.9	46 to 49.9	30 to 45.9		20 to 29.9		<20	
White Blood Count (total/mm3) (in 1000s)	≥40		20 to 39.9	15 to 19.9	3 to 14.9		1 to 2.9		<1	
Glasgow Coma Score (GCS) Score = 15 minus actual GCS										
A. Total Acute Physiology Score (sum of 12 above points)										
B. Age points (years) ≤44=0; 45 to 54=2; 55 to 64=3; 65 to 74=5; ≥75=6										
C. Chronic Health Points (see below)										
Total APACHE II Score (add together the points from A+B+C)										

Chronic Health Points: If the patient has a history of severe organ system insufficiency or is immunocompromised as defined below, assign points as follows:

- 5 points for nonoperative or emergency postoperative patients
- 2 points for elective postoperative patients

Definitions: organ insufficiency or immunocompromised state must have been evident prior to this hospital admission and conform to the following criteria:

- **Liver** – biopsy proven cirrhosis and documented portal hypertension; episodes of past upper GI bleeding attributed to portal hypertension; or prior episodes of hepatic failure/encephalopathy/coma.
- **Cardiovascular** – New York Heart Association Class IV.
- **Respiratory** – Chronic restrictive, obstructive, or vascular disease resulting in severe exercise restriction (i.e., unable to climb stairs or perform household duties; or documented chronic hypoxia, hypercapnia, secondary polycythemia, severe pulmonary hypertension (>40 mmHg), or respirator dependency.
- **Renal** – receiving chronic dialysis.
- **Immunocompromised** – the patient has received therapy that suppresses resistance to infection (e.g., immunosuppression, chemotherapy, radiation, long term or recent high dose steroids, or has a disease that is sufficiently advanced to suppress resistance to infection, e.g., leukemia, lymphoma, AIDS).

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DATA SPREADSHEET

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	SERIALNO	PRIORITY		ASAGRADE	SEX	COMORBID	AGE	IMMUNOS	APACHESC	BLOODLOS	SICUADMI	WASIRRIG	PRIMARYR
2	1	EMERGENCY		1	MALE		39	NO	12	250	2/2/2012	NO	POSTOPER
3	2	EMERGENCY		2	FEMALE	DIABETES M	52	NO	8	200	2/2/2012	YES	HEMODYN
4	3	EMERGENCY		1	FEMALE		25	NO	9	200	2/2/2012	YES	MONITORI
5	4	EMERGENCY		2	FEMALE	OTHERS	20	NO	11	500	2/3/2012	YES	POSTOPER
6	5	ELECTIVE		1	FEMALE		35	NO	8	500	2/3/2012	YES	HEMODYN
7	6	EMERGENCY		1	FEMALE		22	NO	18	400	2/4/2012	YES	MONITORI
8	7	EMERGENCY		1	FEMALE		35	NO	19	2000	3/4/2012	NO	POSTOPER
9	8	EMERGENCY		1	FEMALE		19	NO	10	200	2/5/2012	YES	MONITORI
10	9	EMERGENCY		3	FEMALE	OTHERS	30	NO	9	1000	2/5/2012	NO	MONITORI
11	10	EMERGENCY		3	MALE	DIABETES M	58	NO	17	600	2/6/2012	YES	POSTOPER
12	11	ELECTIVE		3	FEMALE	HYPERTENS	61	NO	16	600	2/9/2012	YES	MONITORI
13	12	EMERGENCY		1	MALE		45	NO	9	250	########	YES	POSTOPER
14	13	ELECTIVE		2	FEMALE	HYPERTENS	48	NO	10	300	########	YES	MONITORI
15	14	EMERGENCY		3	FEMALE	HYPERTENS	60	NO	19	400	########	NO	POSTOPER
16	15	ELECTIVE		1	MALE		55	NO	11	500	########	YES	MONITORI
17	16	EMERGENCY		1	MALE		40	NO	15	400	########	YES	POSTOPER
18	17	EMERGENCY		1	MALE		84	NO	21	200	########	NO	POSTOPER
19	18	EMERGENCY		1	MALE		35	NO	7	100	########	YES	POSTOPER
20	19	EMERGENCY		3	MALE	DIABETES M	34	NO	13	200	########	NO	POSTOPER
21	20	EMERGENCY		1	MALE		56	NO	16	200	########	NO	POSTOPER
22	21	EMERGENCY		2	MALE	DIABETES M	36	NO	11	100	########	YES	POSTOPER
23	22	EMERGENCY		3	FEMALE	OTHERS	36	YES	17	50	########	NO	POSTOPER
24	23	ELECTIVE		1	MALE		53	NO	12	300	########	YES	MONITORI
25	24	EMERGENCY		3	FEMALE	OTHERS	26	NO	11	3000	########	NO	HEMODYN
26	25	EMERGENCY		3	FEMALE	OTHERS	46	NO	13	1500	########	NO	HEMODYN
27	26	ELECTIVE		1	FEMALE		36	NO	10	2800	########	NO	MONITORI
28	27	EMERGENCY		1	FEMALE		45	NO	9	200	########	YES	POSTOPER
29	28	ELECTIVE		1	FEMALE		49	NO	4	400	########	NO	MONITORI
30	29	ELECTIVE		2	MALE	HYPERTENS	66	NO	26	800	########	YES	POSTOPER
31	30	EMERGENCY		1	MALE		70	NO	13	200	########	NO	POSTOPER
32	31	ELECTIVE		1	FEMALE		25	NO	17	1000	########	NO	MONITORI
33	32	EMERGENCY		1	MALE		59	NO	17	200	########	NO	MONITORI

DATA SPREADSHEET

	A	B	C	D	E	F	G	H	I	J	K	L	M
34	33	EMERGENCY		1	MALE		22	NO	7	300	########	YES	POSTOPER
35	34	EMERGENCY		2	FEMALE	HYPERTEN	35	NO	16	150	########	YES	POSTOPER
36	35	EMERGENCY		2	MALE	OTHERS	55	NO	15	200	########	YES	POSTOPER
37	36	EMERGENCY		2	MALE	HYPERTEN	51	NO	17	200	3/1/2012	YES	POSTOPER
38	37	EMERGENCY		3	MALE	OTHERS	54	NO	17	50	3/1/2012	YES	POSTOPER
39	38	ELECTIVE		1	MALE		43	NO	13	500	3/2/2012	YES	MONITORI
40	39	EMERGENCY		1	MALE		60	NO	17	50	3/2/2012	YES	POSTOPER
41	40	EMERGENCY		1	MALE		50	NO	23	100	3/4/2012	YES	POSTOPER
42	41	ELECTIVE		2	MALE	HYPERTEN	33	NO	6	300	3/5/2012	YES	POSTOPER
43	42	ELECTIVE		1	FEMALE		56	NO	16	500	3/5/2012	YES	MONITORI
44	43	ELECTIVE		1	MALE		31	NO	8	300	3/5/2012	YES	POSTOPER
45	44	EMERGENCY		1	FEMALE		43	NO	13	100	3/6/2012	YES	POSTOPER
46	45	ELECTIVE		1	FEMALE		25	NO	13	400	3/6/2012	YES	POSTOPER
47	46	EMERGENCY		2	FEMALE	OTHERS	50	NO	16	150	3/6/2012	YES	POSTOPER
48	47	ELECTIVE		2	MALE	HYPERTEN	59	NO	13	2000	3/7/2012	YES	POSTOPER
49	48	ELECTIVE		1	FEMALE		41	NO	7	300	3/7/2012	YES	HEMODYN
50	49	EMERGENCY		1	MALE		24	NO	13	100	3/8/2012	YES	MONITORI
51	50	ELECTIVE		1	MALE		58	NO	8	750	3/9/2012	YES	POSTOPER
52	51	EMERGENCY		3	FEMALE	OTHERS	23	NO	2	500	########	YES	POSTOPER
53	52	EMERGENCY		1	FEMALE		28	NO	19	100	3/9/2012	YES	POSTOPER
54	53	EMERGENCY		1	FEMALE		21	NO	9	500	########	YES	MONITORI
55	54	EMERGENCY		1	FEMALE		25	NO	21	4500	########	YES	POSTOPER
56	55	ELECTIVE		4	MALE	CRF	60	YES	21	500	########	YES	MONITORI
57	56	EMERGENCY		1	MALE		18	NO	12	200	########	YES	POSTOPER
58	57	ELECTIVE		1	MALE		21	NO	21	6000	########	YES	HEMODYN
59	58	EMERGENCY		3	FEMALE	OTHERS	36	YES	7	100	########	NO	POSTOPER
60	59	EMERGENCY		2	MALE	HYPERTEN	75	NO	13	400	########	YES	MONITORI
61	60	ELECTIVE		1	MALE		49	NO	13	800	########	YES	MONITORI
62	61	EMERGENCY		1	MALE		35	NO	7	50	########	NO	MONITORI
63	62	EMERGENCY		1	MALE		50	NO	9	400	########	YES	MONITORI
64	63	EMERGENCY		2	FEMALE	DIABETES M	54	NO	14	200	########	NO	POSTOPER
65	64	EMERGENCY		2	MALE	DIABETES M	73	NO	22	100		YES	POSTOPER
66	65	ELECTIVE		2	MALE	DIABETES M	59	NO	11	800	########	YES	MONITORI

DATA SPREADSHEET

	A	B	C	D	E	F	G	H	I	J	K	L	M
67	66	ELECTIVE		3	FEMALE	DIABETES M	58	NO	19	50	########	NO	HEMODYN
68	67	ELECTIVE		1	FEMALE		41	NO	11	1000	########	YES	MONITORI
69	68	EMERGENCY		1	MALE		35	NO	9	600	########	NO	POSTOPER
70	69	EMERGENCY		2	MALE	DIABETES M	69	NO	11	50	########	YES	POSTOPER
71	70	ELECTIVE		1	FEMALE		44	NO	6	2000	########	YES	POSTOPER
72	71	ELECTIVE		2	MALE	HYPERTENS	59	NO	27	300	########	YES	POSTOPER
73	72	ELECTIVE		2	MALE	HYPERTENS	58	NO	10	4000	1/3/2012	YES	HEMODYN
74	73	EMERGENCY		1	FEMALE		29	NO	12	300	1/4/2012	YES	POSTOPER
75	74	EMERGENCY		3	FEMALE	CRF	43	NO	10	100	1/4/2012	YES	MONITORI
76	75	ELECTIVE		2	MALE	DIABETES M	61	NO	17	1500	1/6/2012	YES	POSTOPER
77	76	EMERGENCY		1	MALE		67	NO	16	200	1/3/2012	YES	POSTOPER
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DATA SPREADSHEET

	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1	TOTALCRYS	DIAGNOSIS	TOTALCOLI	OPERATIOI	BLOODTRA	TYPEOFSUI	FFPML	ANAESTHE	DURATIONOFSURGER		PRCUNITS	METABOLI	CRYOPPTU
2	2000	PROXIMAL	1000	LAPAROTO	0	MAJOR	0	GENERAL	########		0	YES	0
3	1500	FECAL PERI	500	LAPAROTO	350	MAJOR	0	GENERAL	########		0	YES	0
4	1000	POST ANTE	0	LAPAROTO	350	MAJOR	0	GENERAL	########		0	NO	0
5	500	HEMOPERI	0	LAPAROTO	700	MAJOR	0	GENERAL	########		0	YES	0
6	3500	DUODENAI	1000	WHIPPLES	350	MAJOR	0	GENERAL	########		0	NO	0
7	1500	ADHESIVE	500	EXPLORAT(	0	MAJOR	0	GENERAL	########		0	YES	0
8	2000	GASTRIC PI	1000	LAPAROTO	700	MAJOR	0	GENERAL	########		0	YES	0
9	1500	ANASTOM(	500	LAPAROTO	0	MAJOR	0	GENERAL	########		0	NO	0
10	1000	POST OP LS	500	LAPAROTO	0	MAJOR	1000	GENERAL	########		0	NO	0
11	1000	SMALL BO\	1000	LAPAROTO	350	MAJOR	0	GENERAL	########		0	NO	0
12	2500	PAOD	1000	AORTO BII	0	MAJOR	0	GENERAL	########		0	YES	0
13	1500	BLUNT INJ	500	EXPLORAT(	0	MAJOR	0	GENERAL	########		0	NO	0
14	2000	PERIAMPU	500	WHIPPLE'S	0	MAJOR	0	GENERAL	########		0	NO	0
15	2500	STRANGUL	1000	LAPAROTO	0	MAJOR	0	GENERAL	########		0	YES	0
16	3500	ADENOCAF	1000	WHIPPLE'S	0	MAJOR	0	GENERAL	########		0	YES	0
17	1000	FAECAL PE	500	LAPAROTO	0	MAJOR	0	GENERAL	########		0	NO	0
18	1500	DUODENAI	0	LAPAROTO	0	MAJOR	0	GENERAL	########		0	YES	0
19	1000	JEJUNAL PE	500	LAPAROTO	350	MAJOR	0	GENERAL	########		0	YES	0
20	1500	DUODENAI	500	LAPAROTO	0	MAJOR	0	GENERAL	########		0	YES	0
21	1500	DUODENAI	500	LAPAROTO	0	MAJOR	0	GENERAL	########		0	YES	0
22	1000	RUPTURED	500	LAPAROTO	0	MAJOR	0	GENERAL	########		0	NO	0
23	1000	ACUTE GAI	500	LAPAROTO	1400	MAJOR	0	GENERAL	########		0	YES	0
24	3500	PERIAMPU	500	WHIPPLES	350	MAJOR	0	GENERAL	########		0	NO	0
25	2500	ATONIC PP	1000	PERIPARTU	1050	MAJOR	3000	GENERAL	########		12	YES	12
26	350	SECONDAR	0	EXPLORAT(	1750	MAJOR	3500	GENERAL	########		0	YES	20
27	4000	SEVERE PEI	1000	LAPAROTO	1050	MAJOR	0	GENERAL	########		0	NO	0
28	1500	PERITONIT	500	LAPAROTO	0	MAJOR	0	GENERAL	########		0	YES	0
29	1500	ILEOCAECA	500	R HEMICOI	350	MAJOR	0	GENERAL	########		0	NO	0
30	2000	RETROPERI	500	LAPAROTO	0	MAJOR	0	GENERAL	########		0	YES	0
31	1000	ANASTOM(	500	EXPLORAT(	0	MAJOR	0	GENERAL	########		0	NO	0
32	2500	ANGIOMY(	1000	EXCISION (	700	MAJOR	0	GENERAL	########		0	NO	0
33	2000	PERITONIT	1000	LAPAROTO	0	MAJOR	0	GENERAL	########		0	YES	0

DATA SPREADSHEET

	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
34	2000	LIVER LACE	500	LAPAROTO	700	MAJOR	0	GENERAL	########		0	YES	0
35	2000	DUODENAI	500	LAPAROTO	0	MAJOR	0	GENERAL	########		0	YES	0
36	1500	DUODENAI	1000	LAPAROTO	0	MAJOR	0	GENERAL	########		0	YES	0
37	1500	ANASTOM(	500	LAPAROTO	350	MAJOR	0	GENERAL	########		0	YES	0
38	1000	GANGRENI	500	LAPROTOM	0	MAJOR	0	GENERAL	########		0	YES	0
39	2000	PERIAMPU	1000	WHIPPLES	0	MAJOR	0	GENERAL	########		0	NO	0
40	1000	DUODENAI	500	LAPAROTO	0	MAJOR	0	GENERAL	########		0	NO	0
41	1000	BLUNT INJ	1000	EXPLORAT(	0	MAJOR	0	GENERAL	########		0	YES	0
42	1500	BILATERAL	1000	BILATERAL	0	MAJOR	0	GENERAL	########		0	YES	0
43	2000	SIGMOID P	500	SIGMOID C	0	MAJOR	0	GENERAL	########		0	YES	0
44	1500	RECTAL PR	500	OPEN SUTU	0	MAJOR	0	GENERAL	########		0	YES	0
45	1000	ACUTE GAI	500	LAPAROTO	0	MAJOR	0	GENERAL	########		0	NO	0
46	2000	CORROSIVI	1000	COLON PU	0	MAJOR	0	GENERAL	########		0	NO	0
47	1000	ANASTOM(	500	LAPAROTO	0	MAJOR	0	GENERAL	########		0	NO	0
48	4000	RIGHT RCC	1000	OPEN RADI	700	MAJOR	0	GENERAL	########		0	NO	0
49	1500	SIGMOID P	500	HARTMAN	0	MAJOR	0	GENERAL A	########		0	YES	0
50	1000	SUBACUTE	500	LAPAROTO	0	MAJOR	0	GENERAL	########		0	NO	0
51	2000	LIVER MET	1000	HEPATIC SI	0	MAJOR	0	GENERAL	########		0	NO	0
52	1000	PERIPARTU	0	LSCS	0	MAJOR	0	GENERAL	########		0		0
53	500	RUPTURED	0	LEFT SALPI	1050	MAJOR	0	GENERAL	########		0		0
54	1000	PRIMIGRAV	0	LSCS	0	MAJOR	0	REGIONAL	########		0		0
55	1500	ATONIC PP	1500	LSCS	7000	MAJOR	4500	GENERAL	########		8	YES	36
56	2000	ESRD ON M	500	RENAL TRA	0	MAJOR	0	GENERAL	########		0	YES	0
57	1500	JEJUNAL PE	500	LAPAROTO	0	MAJOR	0	GENERAL	########		0	YES	0
58	5000	R ADRENAI	1500	EXCISION C	4200	MAJOR	2000	GENERAL	########		12	YES	12
59	1000	ACUTE GAI	500	LAPAROTO	0	MAJOR	0	GENERAL	########		0	NO	0
60	2000	LARGE BOV	500	LEFT HEMI(	0	MAJOR	0	GENERAL	########		0	NO	0
61	3000	TCC BLADD	1000	RADICAL C	0	MAJOR	0	GENERAL A	########		0	NO	0
62	1500	PERFORAT	500	LAPAROTO	0	MAJOR	0	GENERAL	########		0	NO	0
63	2000	BURST ABD	500	SECONDAR	0	MAJOR	0	GENERAL	########		0		0
64	1500	HEMOPERI	1000	EXPLORAT(	0	MAJOR	0	GENERAL	########		0	NO	0
65	1000	INTRA ABD	500	LAPAROTO	0	MAJOR	0	GENERAL	########		0	YES	0
66	4000	TCC BLADD	1000	RADICAL C	350	MAJOR	0	GENERAL A	########		0	NO	0

DATA SPREADSHEET

	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
67	1500	DISSEMINA	500	LAPAROTO	0	MAJOR	0	GENERAL	########		0	YES	0
68	4000	CA OVARY	500	TAH BSO R	350	MAJOR	0	GENERAL A	########		0	NO	0
69	2500	BLUNT TRA	500	EXPLORAT(	350	MAJOR	0	GENERAL	########		0		0
70	1000	STRANGUL	0	EXPLORAT(	0	MAJOR	0	GENERAL	########		0	YES	0
71	4000	CA GB	1000	EXTENDED	350	MAJOR	0	GENERAL	########		0	YES	0
72	3000	CA HEAD P	1000	WHIPPLES	0	MAJOR	0	GENERAL	########		0	YES	0
73	6000	HCC	500	SEGMENTE	1400	MAJOR	1000	GENERAL	########		0	NO	0
74	1500	JEJUNAL PE	500	EXPLORAT(	0	MINOR	0	GENERAL	########		0	NO	0
75	1000	SHORT GU	500	JEJUNO ILE	0	MAJOR	0	GENERAL	########		0	NO	0
76	4000	SOL LIVER	1000	SECTIONEC	0	MAJOR	0	GENERAL	########		0	NO	0
77	1000	CA STOMA	500	RE EXPLOR	0	MAJOR	0	GENERAL	########		0	YES	0
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DATA SPREADSHEET

	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM
1	EXTUBATEI	WASTEMP	DELAYEDA	HYPOTHER	NOTEXTUB	LOWESTTE	FIO2ADM	DURATION	PHADM	HYPOTENS	PAO2ADM	HYPOTENS	NEWONSE
2	NO	YES	NO	YES	NO	35	0.3	2	7.3	YES	128	NO	NO
3	NO	YES		YES	NO	35	0.5	2.5	7.229	YES	100	NO	NO
4	YES	YES	NO	YES		35.8	0.21	0.5	7.5	NO	106		NO
5	NO	YES		NO	NO	36	0.3	1	7.416	NO	147	NO	NO
6	NO	YES		YES	YES	34.6	0.6	10	7.33	YES	319	YES	NO
7	NO	YES		YES	NO	35.4	0.6	3	7.34	NO	248	NO	NO
8	NO	YES		YES	NO	33	0.6	3.5	7.12	YES	149	NO	NO
9	YES	YES	NO	YES	NO	35.6	0.21	2.5	7.49	NO	75.9	NO	NO
10	YES	NO	NO				0.35		7.42	NO	129		NO
11	YES	YES	NO	YES		35	0.21	3	7.32	NO	102		NO
12	NO	YES		YES	NO	34.6	0.6	4.5	7.46	YES	110	NO	YES
13	NO	YES		YES	NO	36	0.6	2.5	7.19	NO	116		NO
14	YES	YES	NO	YES		35.2	0.6	8	7.51	NO	257		NO
15	NO	YES		YES	NO	34.9	0.6	5.5	7.32	NO	176		NO
16	YES	YES	NO	YES		35.2	0.3	13	7.34	NO	280		NO
17	NO	YES		YES	NO	35.6	0.5	2.5	7.42	NO	166		NO
18	NO	YES		NO	NO	36.6	0.35	0	7.18	YES	156	NO	NO
19	NO	YES		YES	NO	34.9	0.6	3	7.24	YES	139	NO	NO
20	NO	YES		YES	NO	35.2	0.6	1	7.23	NO	123		NO
21	NO	YES		YES	NO	35.6	0.5	1	7.25	NO	102		NO
22	NO	YES		YES	NO	35.8	1	2	7.32	NO	102		NO
23	NO	YES		YES	NO	35	0.4	1	7.21		90.5	NO	YES
24	YES	YES	NO	YES		35.2	0.6	7	7.4	NO	225	NO	NO
25	NO	YES		YES	NO	33.2	0.3	4	7.36	YES	141	NO	NO
26	NO	YES		YES	NO	34.7	0.6	1.5	7.05	NO	110		NO
27	NO	YES		YES		33.3	0.21	3	7.37	NO	237		NO
28	NO	YES		YES	NO	36	0.3	3	7.4	NO	92.9		NO
29	NO	YES		YES	NO	35.5	0.24	2	7.36	YES	223	NO	NO
30	NO	YES		YES	NO	35.6	0.3	3	7.18	YES	155	NO	NO
31	NO	YES		YES	NO	35.6	0.6	2	7.23	NO	225		NO
32	NO	YES		YES	NO	34.9	0.5	2	7.37	YES	249	NO	NO
33	NO	YES		YES	NO	35.2	0.5	3	7.07	YES	163	NO	NO

DATA SPREADSHEET

	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM
34	NO	YES		YES	NO	35.1	0.5	2	7.23		178	NO	NO
35	NO	YES		YES	NO	35.2	0.4	2	7.28	YES	71.8	NO	NO
36	NO	YES		YES	NO	35.4	0.3	2	7.4	YES	68.7	NO	NO
37	NO	YES		YES	NO	35.6	0.3	2	7.31	YES	109	NO	NO
38	NO	YES		YES	NO	36		1		YES		NO	NO
39	YES	YES	NO	YES		34.9	0.6	7	7.4	NO	237	NO	NO
40	NO	YES		YES	NO	35.3	0.4	1	7.38	NO	82.3	NO	NO
41	NO	YES		YES	NO	34.9	0.5	5	7.17	YES	69.5	NO	NO
42	NO	YES		YES	NO	36	0.5	4	7.27	YES	147	NO	NO
43	YES	YES	NO	YES		35.1	0.3	4	7.19	NO	86.5	NO	NO
44	NO	YES		YES	NO	34.3	0.3	3	7.44	NO	152		NO
45	NO	YES		YES	NO	36.1	0.6	2	7.41	YES	111	NO	NO
46	NO	YES		YES	NO	35.4	0.6	7	7.29	NO	281		NO
47	NO	YES		YES	NO	35	0.3	2.5	7.36	NO	84.8		NO
48	NO	YES		YES	NO	34	0.6	3	7.41	NO	330		NO
49	NO	YES		YES	NO	35.2	0.5	4	7.47	YES	22	NO	NO
50	YES	YES	NO	YES		35.6	0.6	2	7.47	NO	322		NO
51	NO	YES		YES	NO	35.6	0.5	3.5	7.44	NO	200		NO
52	NO	NO			NO		0.5		7.08	NO	104	NO	NO
53	NO	YES		YES	NO	35.2	0.3	1	7.07	NO	149		
54		NO					0.6		7.45	NO	110		NO
55	NO	YES		YES	NO	33.8	0.21	10	6.8	YES	330	NO	NO
56	NO	YES		YES	NO	35.2	1	4	6.98	NO	78.1		NO
57	NO	YES		YES	NO	35.2	0.4	2	7.27	NO	149		NO
58	NO	YES		YES	NO	32.7	0.45	4.5	7.19	YES	175	NO	YES
59	NO	YES		YES	NO	35.5	0.6	2	7.4	NO	237		NO
60	YES	YES	NO	YES		35.5	0.21	4	7.38	NO	44		NO
61	YES	YES	NO	YES		35	0.6	7	7.33	YES	163	NO	NO
62	NO	YES		YES	NO	35.8	0.6	3	7.31	NO	73.1		NO
63	YES	YES	NO	YES		35.8	0.21	3	7.44	NO	80		NO
64	NO	YES		YES	NO	35.7	0.6	2	7.39	NO	149		NO
65	NO	YES		YES	NO	36	1	3	7.37	NO	69.1		NO
66	YES	YES	NO	YES		35.1	0.3	8	7.41	NO	122		NO

DATA SPREADSHEET

	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM
67	NO	YES		YES	NO	35.6	0.3	3	7.29	YES	140	NO	NO
68	YES	YES	NO	YES		35	0.21	7	7.34	NO	229		NO
69	NO	NO		NO	NO		0.8		7.36	NO	73.9		NO
70	NO	YES		NO	NO	36.7	0.5	2	6.94	YES	78.5	NO	NO
71	YES	YES	NO	YES		34.6	0.5	7	7.27	NO	276		NO
72	NO	YES		YES	NO	35.2	0.6	10	7.26	YES	246	NO	NO
73	YES	YES	NO	YES		33.8	0.5	7	7.42	YES	98.6	NO	NO
74	NO			YES	NO	35.3	0.3	2	7.46	NO	140		NO
75	YES	YES	NO	YES		35.1	0.21	3	7.49	NO	57.8		NO
76	YES	YES	NO	YES		34.8	0.6	10	7.44	NO	248		NO
77	NO	YES		YES	NO	35.4	0.3	2	7.37	YES	145		NO
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DATA SPREADSHEET

	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ
1	ABGDONE	PACO2ADM	HCO3ADM	BEADM	Column1	LACTATEAD	SPO2ADM	HBADM	NAADM	KADM	CLADM	CAADM	FIO2NORM
2	YES	36	19.5	-6		3.3	98.2	16.7	132	4	113	1.13	0.3
3	YES	42.7	17	-9.2		0.9	96.7	7	138	3.6	113	1.1	0.3
4	YES	18.7	18.2	-7.5		1.9	98.1	6.6	129	3.5	104	1.02	0.24
5	YES	38.1	24.5	0.1		0.8	98.7	8.8	139	3.2	110	1.09	0.35
6	YES	40.7	21	-4.2		0.8	99	11.1	134	2.9	108	1.1	0.3
7	YES	33	18.9	-6.8		2.4	98.7	10.9	133	3	109	1.04	0.3
8	YES	44.6	13.6	-14		6.4	99	9.1	134	3.5	108	1.06	0.3
9	YES	29.1	24.5	0.1		1	95.7	11.1	142	4.5	96	1.31	0.35
10	YES	36.9	24.4	0		1.1	98.6	7.6	133	3.4	108	1.04	0.21
11	YES	24.3	15.4	-11.9		4.6	97.9	15.1	122	3.3	106	1.06	0.21
12	YES	36.2	26.5	2.4		4.5	98.1	10.8	134	2.5	101	1.07	0.3
13	YES	54.9	18.2	-7.8		1.6	96.3	13.2	135	4.1	114	0.98	0.3
14	YES	29.2	25.5	1.2		1.3	99.1	11.2	136	3.4	107	1.1	0.28
15	YES	34.2	18.4	-7.5		3	99.1	10.3	131	3.3	109	0.92	0.3
16	YES	38.1	20.6	-4.6		7.4	99.3	12.2	135	4.2	112	1.08	0.3
17	YES	36.6	24.4	0		1.3	98.4	9	131	2.1	104	0.88	0.3
18	YES	21.5	10.3	-19		20	98	9.6	135	5.2	100	0.84	0.45
19	YES	42.4	17.4	-8.8		3.4	98.4	12.2	132	4.2	110	1.05	0.5
20	YES	44.9	17.5	-8.7		0.6	97.5	12.2	136	3.2	111	1.19	0.3
21	YES	39.4	17.2	-9.3		1.8	96	15.6	131	3.9	115	1.04	0.3
22	YES	47.4	23	-1.6		1.2	97	11.3	123	5.5	98	0.97	0.3
23	YES	37.3	14.9	-12		6.7	95.2	8.7	139	3.3	117	0.87	0.3
24	YES	42.9	26.4	2.3		1.1	98.3	8	140	2.7	109	1.13	0.4
25	YES	30.6	18.4	-7.3		6	98.9	6.6	138	5.6	111	1	0.21
26	YES	52.7	12.5	-15.8		20	95.9	11.4	140	4.2	104	1.15	0.24
27	YES	42.1	23.9	-0.7		1.6	99	9.1	137	3.3	110	1.25	0.3
28	YES	35.3	22.6	-2.2		1.5	97.2	9.7	144	3.5	118	1.12	0.3
29	YES	35.4	20.9	-4.3		1.1	99	11.3	137	3.8	114	1.03	0.4
30	YES	44.5	15.6	-11.3		8.5	98.5	11.3	139	4.5	111	0.92	0.21
31	YES	38.1	16	-10.7		3.5	99	10.5	138	3.1	117	1.02	0.24
32	YES	35.1	20.8	-4.4		1.5	99.3	8.7	137	3.8	115	1.11	0.3
33	YES	34.1	10.1	-19		11.7	97.8	8.2	127	2.8	105	1.08	0.3

DATA SPREADSHEET

	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ
34	YES	49.1	19.1	-6.4		3.4	98.8	6.9	141	3.8	119	0.94	0.3
35	YES	45.9	20.3	-4.8		4.5	93.5	9.2	140	3.6	115	1.15	0.3
36	YES	28.3	19.5	-5.9		3.4	94.4	12.7	137	3.2	117	0.98	0.3
37	YES	31.5	17.1	-9.1		5.7	99.2	10.1	137	3.5	113	1.04	0.35
38	YES												
39	YES	39.7	24.7	0.3		1.8	99.6	10.2	134	3.9	106	1.11	0.6
40	YES	24.5	17.2	-9		1.4	94.9	10.5	141	3	125	0.91	0.3
41	YES	40.4	14.1	-13		6	92.2	12.9	145	3	121	1.02	0.6
42	YES	39.7	18.2	-7.7		8.5	98.6	11.3	138	4.6	110	1.13	0.3
43	YES	53.7	17.8	-8.2		1.6	94.3	11.4	137	3.8	110	1.01	0.3
44	YES	30	22.8	-2		2.8	98.9	15.7	131	3.8	107	1.11	0.3
45	YES	32.1	21.6	-3.4		1.2	98.1	10	139	3	115	1.07	0.3
46	YES	39.8	18.9	-6.8		1.3	99.7	13.2	138	2.8	116	1.07	0.21
47	YES	29.1	18.2	-7.6		4.7	95.9	9.5	133	2.4	112	1.03	0.24
48	YES	33.9	22.5	-2.3		1.1	99.6	12.4	137	3.3	111	1.07	0.21
49	YES	28	22.5	-2.3		2.2	99.2	9.3	131	2.9	106	0.99	0.24
50	YES	31.7	25	0.6		2.3	99.3	11.9	131	2.4	104	0.94	0.21
51	YES	32.4	23.5	-1.1		1	99.4	8.8	136	3.5	108	1.15	0.3
52	NO	63	14.8	-12.4		3.6	93.1	11.9	134	5.2	109	1.07	0.3
53	NO	40.6	11.1	-19.2		4.6	97.7	16.2	133	4.1	117	1.09	0.3
54	NO	26.7	21	-4.1		1.6	98.1	10.2	133	4.5	112	1.16	0.21
55	YES	24.5	4.3	-26.7		19	97.7	2.5	151	5.6	117	1.03	1
56	YES	100	15.9	-10.6		1.8	85.1	10.7	132	6.2	107	1.12	0.6
57	YES	41.7	18.6	-7.3		2.8	98.4	13.3	131	4.1	111	1.09	0.3
58	YES	37.2	14.3	-12.7		0.8	99	6.9	132	3.2	105	1.2	1
59	YES	39.7	24.7	0.3		1.8	99.6	10.2	134	3.9	106	1.11	0.6
60	YES	34.5	20.9	-3.8		1.7	75.9	10.9	132	3.3	111	1.05	0.6
61	YES	41.7	21.6	-3.4		1.1	98.4	11	139	3.8	115	1.07	0.3
62	YES	40.6	20.1	-5.2		1.1	92.9	13	137	3.8	111	0.83	0.24
63	NO	21.3	17.5	-8.4		5.4	94.7	7.9	128	3.5	101	1.05	0.21
64	YES	36.8	22.5	-2.3		1.2	98.8	9.5	138	3.1	110	1.07	0.3
65	YES	22.3	17.9	-8		1.3	92.3	10.3	128	4.1	107	1.09	0.21
66	YES	29.7	20.5	-4.7		6.2	98.5	11.6	138	3.9	113	1.05	0.21

DATA SPREADSHEET

	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ
67	YES	41.1	19.1	-6.5		2.7	97.5	12.2	144	2.9	123	1.07	0.31
68	YES	34.4	19.3	-6.2		1.4	99.4	9.7	140	3.1	118	0.99	0.3
69	NO	44.5	24.1	-0.3		0.9	93.3	9.6	139	4.3	112	1.18	0.3
70	YES	49	8.8	-21.8		10	87.2	11.2	136	4.1	114	1.03	0.6
71	YES	36.5	17.1	-9.1		6.9	98.6	8.6	137	3.5	111	1.08	0.6
72	YES	44.8	19	-6.6		3.2	99.1	11	133	2.9	110	1.09	0.6
73	YES	32.2	22.4	-2.4		8.3	98.2	8.7	140	4.2	108	0.86	0.3
74	YES	31.5	24.2	-0.3		1.4	99.2	8.9	134	3.2	101	1.09	0.3
75	YES	15.2	16.1	-10.3		7.8	90.1	9.4	126	5.9	103	1.01	0.3
76	YES	31.4	23.4	-1.2		2.6	99.4	14.2	137	3.2	109	1.12	0.3
77	YES	33.3	20.3	-4.9		6	99.1	8.6	134	4.1	108	1.18	0.35
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DATA SPREADSHEET

	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL	BM
1	PHNORM	PAO2NORM	PACO2NOF	HCO3NORI	BENORM	LACTATEN(	SPO2NORM	HBNORM	NANORM	KNORM	Column1	CLNORM	CANORM
2	7.4	121	36.2	27.8	3.8	1.4	98.6	15	134	4.5		105	1.04
3	7.361	113	29.4	18.1	-7.7	2.9	98	9.8	137	3.8		113	1.07
4	7.4	135	23.2	17.2	-9.1	2.1	98.8	10.2	127	3.7		100	1.17
5	7.41	136	33	22.1	-2.8	1.7	98.3	9.6	127	4.1		103	1.09
6	7.45	102	28	22.1	-2.8	3.9	98.9	8.5	145	4		118	1.07
7	7.3	169	36	18.3	-7.6	3.9	98.2	11.7	131	3.9		106	1.13
8	7.45	102	28	22.1	-2.8	3.9	98.9	8.5	145	4		118	1.07
9	7.41	136	33	22.1	-2.8	1.7	98.3	9.6	127	4.1		96	1.31
10	7.32	75	35	23.8	-0.7	1.2	98.5	8.2	135	3.3		112	1.08
11	7.39	82.6	27.4	19.2	-6.4	1.9	97	14.1	126	3.2		107	1.08
12	7.42	140	32.6	22.3	-2.6	1.7	98.8	8.5	138	3.9		111	1.05
13	7.42	150	35	23.8	-0.7	1.2	98.5	12.6	129	3.6		106	1.05
14	7.31	129	44.7	21.2	-4	1.9	98.6	13.9	136	3.8		111	1.13
15	7.32	123	35.3	18.7	-7	2.2	98.9	11.3	131	3.8		110	1.04
16	7.38	172	33.5	21.2	-3.9	5.6	99.1	14.7	134	3.8		112	1.08
17	7.43	131	35.3	24.5	0	3.2	98.2	10.5	136	3.1		108	1.03
18	7.39	148	27.1	18.7	-7.1	12.4	99	9.9	136	4.3		100	0.89
19	7.29	195	36.7	18.3	-8.2	3.2	98.9	24	130	3.6		110	1.05
20	7.43	120	32.4	22.6	-2.1	0.5	99.7	9	139	3.2		111	1.14
21	7.4	108	36.1	23.2	-1.5	0.8	97.4	14.4	137	3		118	1.17
22	7.44	97.6	32.7	23.9	-0.7	0.8	97.4	10.5	129	4		106	1.03
23	7.33	102	40.4	21.2	-3.8	1.4	98.1	8.6	140	2.6		108	1.01
24	7.38	87.3	44.1	25.1	0.8	2.4	96.5	13.9	144	3.2		115	1.19
25	7.43	126	18.6	15.9	-10.7	3.5	99.5	8.7	135	3		112	1.05
26	7.35	69.9	29.3	17.8	-8.2	1.5	94.5	12.1	132	4.1		100	1.07
27	7.44	119	39.1	26.9	2.8	0.9	98.4	11.5	134	3.2		107	1.07
28	7.42	105	34.3	23.3	-1.4	0.7	97.7	8.8	137	2.9		107	1.19
29	7.44	90.5	37.9	26.2	2	0.7	96.9	10.8	137	3.1		111	1.06
30	7.47	59.5	44.9	32.3	8.7	0.7	91.5	9.5	139	3.2		102	1.11
31	7.37	112	27.9	18.3	-7.6	3.4	98.2	10.3	138	2.8		117	1.14
32	7.4	111	34.3	22.4	-2.4	2.4	98.4	8.4	137	3.5		114	1
33	7.4	111	34.3	22.4	-2.4	2.4	98.4	8.4	137	3.5		114	1

DATA SPREADSHEET

	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL	BM
34	7.4	82.4	45	27.4	3.3	1.3	97.7	6.5	140	3.7		110	1.02
35	7.42	93.3	40	25.8	1.6	1	98.4	9.9	139	2.9		109	1
36	7.38	133	35.7	21.8	-3.2	1.4	98.4	14.4	137	2.8		115	1.03
37	7.36	110	34.9	20.3	-4.9	0	98.3	10	140	3.3		115	1.06
38													
39	7.34	241	39.1	21.1	-5	2.6	99.4	13.3	132	4.3		107	1.1
40	7.38	111	47.1	27.2	3.1	1.3	98	11.7	135	3.2		106	1.18
41	7.16	104	45.4	15	-12	5.7	97.3	8.7	139	5		113	0.87
42	7.26	64.5	34.4	16.1	-10.4	9.8	90.2	11	135	3.9		108	1.13
43	7.36	123	32.3	19.3	-6.3	1.5	98.4	11.1	135	3.6		111	1.06
44	7.42	93.3	40	25.8	1.6	1	98.4	13	139	2.9		109	1
45	7.45	117	33.5	24.6	0.2	1.2	98.5	9.8	140	2.5		113	1.06
46	7.43	89	36.2	24.5	0.1	1.5	97.9	10.8	130	3.7		104	1.15
47	7.48	83.7	51.1	37.3	13.5	1.7	96.6	9.3	151	3.4		105	0.97
48	7.44	72.9	33.7	23.9	-0.6	0.9	96	9.3	137	3.7		110	1.13
49	7.43	114	34.7	23.9	-0.6	0.8	98.3	10.8	134	2.8		112	1.05
50	7.42	114	23.9	18.5	-7.4	4.4	98.3	10.5	122	3.8		103	1.04
51	7.39	153	42.9	25.6	1.3	1.9	98.9	13.3	137	3.5		108	1.14
52	7.4	95	31.3	20.8	-2.8	1	90.6	10	132	4		108	1.05
53	7.49	65.6	39.2	30.3	6.5	1.1	92.8	10.5	143	3		107	1.05
54	7.42	79.3	26.4	19.3	-6.2	1.9	95.6	9	129	4.1		109	1.11
55	6.95	374	24.4	6	-23.8	21	98.4	2	153	6.7		115	1.15
56	7.32	91.8	37.6	19.3	-6.2	4.1	96.3	7	135	4.1		104	1.04
57	7.4	103	39.3	24.5	0.1	1.1	98	9.4	132	3.5		106	1.17
58	7.09	428	28.4	9.1	-19.4	13.5	99.5	1.9	146	4.1		110	0.57
59	7.34	241	39.1	21.1	-4	2.6	99.4	13.3	132	4.3		107	1.1
60	7.43	191	28.3	20.7	-4.5	1.3	98.4	10.6	132	3.7		113	1.02
61	7.4	125	37.4	23.3	-1.3	3.2	97	8.8	136	4		110	1.04
62	7.38	100	39.5	23.6	-1	1.3	96.5	9.6	141	5		117	0.87
63	7.53	72.4	28.3	26.3	2.2	1.4	94.2	9.9	127	3.1		99	1.07
64	7.54	78.6	26.5	25.5	1.3	2.1	97.3	10.9	135	2.5		107	1.07
65	7.39	69.6	28	18.8	-6.8	1.1	94.8	9.6	128	3.9		108	1.04
66	7.52	70.1	23.5	22.2	-2.6	1.4	96.5	8.4	134	3.1		113	1.05

DATA SPREADSHEET

	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL	BM
67	7.36	147	35.1	16.1	-10.5	2.1	97.9	10.7	146	2.8		128	1.08
68	7.28	172	172	17.8	-8.1	4.7	99	8.7	141	3.8		116	1.08
69	7.42	88.5	37.9	24.7	0.3	0.9	94.6	9.7	140	4.5		115	1.13
70	6.96	99	56.8	10.3	-18.6	10.5	94.2	7.8	143	3.3		116	0.86
71	7.32	113	39.2	20.1	-5.3	7.1	97.8	10	137	3.7		110	1.12
72	7.33	253	38.2	20.5	-4.8	6.5	99.4	11.7	136	3.4		112	1.1
73	7.38	115	43.9	25.1	0.8	4.8	98.3	11.5	142	4		109	1.07
74	7.47	210	33.6	25.9	1.6	0.8	99.2	8.9	134	3.2		101	1.09
75	7.41	122	28.7	19.1	-5.7	6	98.6	6.3	132	3.6		104	1.14
76	7.37	145	33.3	19.7	-5.3	6.5	99.1	8.3	138	4.3		108	1.18
77	7.41	97.5	34.3	22.6	-2.2	0.9	98.3	7.7	140	3.2		108	1.21
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DATA SPREADSHEET

	BN	BO	BP	BQ	BR	BS	BT	BU	BV	BW	BX	BY	BZ
1	ADMISSIOI	TIMETONC	SHIVERING	METABOLI	ARRHYTHM	SURGICALS	VENTILATC	SEPSIS	WOUNDIN	COAGULOF	VENTILATE	DISCHARG	NUMBERO
2	35	3	NO	YES	NO	NO	NO	YES	NO	NO	6	########	8
3	35.4	5	NO	YES	NO	YES	NO	YES	YES	NO	1	2/4/2012	2
4	36	1	NO	NO	NO	NO	NO	YES	NO	NO	0	2/6/2012	5
5	36	2	NO	NO	NO	NO	NO	NO	NO	NO	1	2/4/2012	2
6	35.3	6	NO	NO	NO	YES	NO	NO	YES	NO	2	2/6/2012	4
7	35.4	2	NO	YES	NO	NO	NO	NO	NO	NO	5	2/9/2012	6
8	33	3.5	NO	YES	NO	NO	NO	YES	NO	NO	7	########	8
9	36.1	2	NO	NO	NO	NO	NO	YES	NO	NO	1	2/6/2012	2
10	36	1	YES	NO	NO	NO	NO	NO	NO	YES	0	2/5/2012	1
11	35.6	3	NO	YES	NO	NO	NO	NO	NO	NO	0	2/7/2012	1
12	34.6	6	NO	YES	NO	NO	NO	NO	NO	NO	2	########	3
13	36	2	NO	YES	NO	NO	NO	NO	NO	NO	1	########	1
14	36.1	4	NO	NO	NO	NO	NO	YES	NO	NO	1	########	2
15	35.6	5	NO	YES	NO	YES	NO	NO	YES	NO	4	########	8
16	36.1	3	NO	YES	NO	NO	NO	NO	NO	NO	0	########	2
17	36	1	NO	NO	NO	NO	NO	NO	NO	NO	1	########	2
18	35.6	12	NO	YES	NO	NO	NO	YES	NO	NO	2		2
19	35.2	6	NO	YES	NO	NO	NO	NO	NO	NO	1	########	3
20	35.9	2	NO	NO	NO	NO	NO	YES	NO	NO	1	########	2
21	35.6	1	NO	NO	NO	NO	NO	YES	NO	NO	1	########	2
22	35.2	4	NO	NO	NO	NO	NO	NO	NO	NO	1	########	5
23	35.1	6	NO	YES	NO	YES	NO	YES	YES	NO	7	########	8
24	35.8	2	NO	NO	NO	NO	NO	NO	NO	NO	0	########	1
25	34.9	8	NO	YES	NO	YES	NO	YES	YES	YES	1	########	2
26	36.1	1	NO	YES	NO	NO	NO	NO	NO	YES	5	########	5
27	35.3	3	NO	NO	NO	NO	NO	NO	NO	NO	1	########	3
28	35.8	3	NO	NO	NO	YES	NO	NO	YES	NO	4	########	5
29	36.2	2	NO	NO	NO	NO	NO	NO	NO	NO	0	########	2
30	35	4	NO	YES	NO	NO	NO	NO	NO	NO	6	########	7
31	35.5	2	NO	NO	NO	NO	NO	NO	NO	NO	1	########	2
32	35.6	5	NO	NO	NO	NO	NO	NO	YES	NO	1	########	3
33	34.6	6	NO	YES	NO	NO	NO	YES	NO	NO	4	########	4

DATA SPREADSHEET

	BN	BO	BP	BQ	BR	BS	BT	BU	BV	BW	BX	BY	BZ
34	35	3	NO	YES	NO	NO	NO	NO	NO	NO	4	3/2/2012	8
35	36.2	1	NO	YES	NO	NO	NO	NO	NO	NO	3	3/1/2012	3
36	35	7	NO	YES	NO	NO	YES	YES	NO	NO	23	########	23
37	35.6	3	NO	YES	NO	NO	NO	YES	NO	NO	5	3/7/2012	7
38	36	1	NO	YES	NO	NO	NO	NO	NO	YES	2	3/2/2012	2
39	36	2	NO	NO	NO	NO	NO	NO	NO	NO	0	3/3/2012	2
40	35.9	4	NO	NO	NO	NO	NO	NO	NO	NO	3	3/7/2012	6
41	35.2	6	NO	NO	NO	NO	NO	YES	NO	YES	2	3/7/2012	4
42	36.2	2	NO	NO	NO	NO	NO	NO	NO	NO	1	3/6/2012	2
43	36.3	1	NO	NO	NO	NO	NO	NO	NO	NO	0	3/6/2012	2
44	36	2	NO	NO	NO	NO	NO	NO	NO	NO	1	3/6/2012	2
45	35.6	3	NO	NO	NO	NO	NO	YES	NO	NO	3	3/8/2012	3
46	35.6	2	NO	NO	NO	NO	NO	NO	NO	NO	1	3/7/2012	1
47	36.1	3	NO	YES	NO	YES	NO	NO	YES	NO	4	########	6
48	35.6	3	NO	NO	NO	NO	NO	NO	NO	NO	1	3/8/2012	2
49	36.2	1	NO	NO	NO	NO	NO	NO	NO	NO	3	########	4
50	36.3	1	NO	NO	NO	NO	NO	NO	NO	NO	0	3/9/2012	2
51	36.3	1	NO	NO	NO	NO	NO	NO	NO	NO	1	########	2
52	36.3	1	NO	NO	NO	NO	NO	NO	NO	NO	4	########	5
53	36.3	1	NO	YES	NO	NO	NO		NO	NO	1	########	2
54	36.3	1	YES	NO	NO	NO	NO	YES	NO	NO	0	########	1
55	34.6	6	NO	YES	NO	NO	NO	NO	NO	YES	1	########	1
56	35.4	4	NO	YES	NO	NO	NO	NO	NO	NO	1	########	1
57	35.7	2	NO	YES	NO	NO	NO	YES	NO	NO	6	########	8
58	34	4	NO	YES	YES	NO	NO	NO	NO	YES	1	########	1
59	36	1	NO	NO	NO	NO	NO	YES	NO	NO	1	########	2
60	36.2	1	YES	NO	NO	NO	NO	NO	NO	NO	0	########	6
61	36	1	NO	NO	NO	NO	NO	NO	NO	NO	0	########	1
62	36.4	1	NO	NO	NO	NO	NO	NO	NO	NO	1	########	3
63	36.4	1	NO	NO	NO	YES	NO	NO	YES	NO	0	########	2
64	35.8	2	NO	NO	NO	NO	NO	NO	NO	NO	0	########	1
65	35.8	3	NO	YES	NO	NO	NO	NO	YES	NO	2	########	2
66	35.5	2	NO	NO	NO	NO	NO	NO	NO	NO	0	########	1

DATA SPREADSHEET

	BN	BO	BP	BQ	BR	BS	BT	BU	BV	BW	BX	BY	BZ
67	35.6	2	NO	YES	NO	NO	NO	YES	NO	NO	1	########	1
68	36	1	NO	NO	NO	NO	NO	NO	NO	NO	1	########	1
69	36	3	NO	NO	NO	NO	NO	NO	NO	NO	4	4/4/2012	14
70	36.2	1	NO	NO	NO	NO	NO	YES	NO	NO	1	########	1
71	35.2	4	YES	YES	NO	NO	NO	NO	NO	NO	3	########	4
72	35	6	NO	NO	NO	NO	YES	NO	NO	NO	15	########	16
73	35	4	NO	NO	NO	NO	YES	NO	YES	NO	0	1/4/2012	2
74	35.8	3	NO	NO	NO	NO	NO	NO	NO	NO	2	1/5/2012	2
75	35.5	1	YES	NO	NO	NO	NO	YES	NO	NO	0	1/6/2012	3
76	35.6	4	YES	NO	NO	NO	NO	NO	YES	NO	2	########	6
77	35	2	NO	NO	NO	NO	YES	YES	NO	NO	8	########	8
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DATA SPREADSHEET

	CA	CB	CC	CD	CE	CF	CG
1	DISCHARG	READMISS	DEATH	HOSPITALE	IFYESTHEN	WHICHPOS	TOPDAY
2	########	NO	NO	72595			
3	########	NO	NO		7		
4	########	NO	NO				
5	2/8/2012	NO	NO				
6	3/3/2012	NO			17		
7	########	YES	NO				
8	########	NO	YES	134745			
9	########	NO					
10	########	NO	NO				
11	########	NO	NO				
12	########	NO	NO				
13	########	NO	NO				
14	########						
15	########	NO	NO				
16	########	NO	NO				
17	########	NO	NO				
18			YES				
19	########	YES	NO				
20	3/2/2012	NO	NO				
21	########	NO	NO				
22	3/4/2012	NO	NO				
23	4/2/2012	YES	YES				
24	3/4/2012	NO	NO				
25	4/9/2012	YES	NO				
26	3/5/2012	NO	NO				
27	########	NO	NO				
28	3/2/2012	NO	NO		10		
29	########	YES	NO				
30	3/3/2012	YES	NO				
31	3/1/2012	NO	NO				
32	3/8/2012	NO	NO		7		
33	3/8/2012	NO	YES				

DATA SPREADSHEET

	CA	CB	CC	CD	CE	CF	CG
34	3/8/2012	NO	NO				
35	########	NO	NO				
36	########	NO	YES				
37	########	NO	NO				
38	3/2/2012	NO	YES				
39	########	NO	NO				
40	########	NO	NO				
41	3/7/2012	NO	YES				
42	########	NO	NO				
43	########	NO	NO				
44	########	NO	NO				
45	########	NO	NO				
46	########	NO	NO				
47	########	NO	NO		10		
48	########	NO	NO				
49	########	NO	NO				
50	########	NO	NO				
51	########	NO	NO				
52	########	NO	NO				
53	########	NO	NO				
54	########	NO	NO				
55	########	NO	YES				
56	########	NO	NO				
57	########	NO	NO				
58	########	NO	NO				
59	########	NO	NO				
60	########	NO	NO				
61	########	NO	NO				
62	########	NO	NO				
63	########	NO	NO		8		
64	########	NO	NO				
65	########	YES	NO		15		
66	4/1/2012	NO	NO				

DATA SPREADSHEET

	CA	CB	CC	CD	CE	CF	CG
67	########	NO	YES				
68	4/1/2012	NO	NO				
69	4/5/2012	NO	NO				
70	########	NO	YES				
71	4/7/2012	NO	NO				
72	########	NO	YES				
73	########	NO	NO		7		
74	########	YES	NO				
75	########	NO	NO				
76	########	NO	NO		9		
77	########	NO	YES				
78							