RESEARCH ARTICLE

Evaluation of Amino Acid Infusion preventive effect on Hypothermia during Spinal Anesthesia for Hip Arthroplasty

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Abstract

Background: Hypothermia increases bleeding during surgery, risk of ischemic heart disease and postoperative wound infection. Intravenous amino acid increases cell synthesis and produces heat. Our goal was evaluating of the effect of amino acid on intraoperative hypothermia under spinal anesthesia.

Methods: This is a randomized, double-blinded clinical trial that 36 adults undergoing Hip Arthroplasty were randomly assigned into two groups of 18 each. One group received Amino Acids solution (Aminoven 10%) 500ml (240ml/h) throughout spinal anesthesia, and control group received saline solution. We measured core body temperature, MAP and HR each 10 minutes, and also postoperative shivering, blood loss, operation time, postoperative BUN and Cr were compared in two groups.

Results: Throughout surgery, the reduction in core temperature was more in the control group than the amino acids group (statistically not clinically). The decrease in core temperature was significantly larger in the controls (0.96°C ± 0.7°C) than in the amino acid patients (0.94°C ± 0.4°C), (P value= 0.02). Postoperative shivering was 73% in the controls regarding 11% in the amino acids patients. Overall, there were no significant statistical differences between other variables that we measured in two groups of patients.

Conclusion: Amino acids infusion during spinal anesthesia exerted a thermogenic effect. Our findings showed hypothermia was less in the aminoacid group, and also postoperative shivering was more in the control group.

Level of evidence: I

Keywords: Amino acid, Anesthesia, Arthroplasty, Hypothermia

Introduction

Accidental hypothermia is the most common perioperative thermal disturbance which is directly associated with perioperative cardiovascular complications such as arrhythmia, myocardial ischemia, hypertension, coagulopathy, and wound infection (1-3). Hypothermia is also one of the reasons for the increase in recovery time and postoperative shivering. Multiple mechanisms may cause perioperative hypothermia such as the cold environment of the operating room (OR), absence of the behavioural response and altered thermoregulatory mechanisms during anaesthesia. Therefore, the enhanced recovery after surgery (ERAS)

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protocol emphasizes on heat control intraoperative and postoperative periods (4-5).

Many devices like water circulator, forced air blankets, resistive heating devices and radiant heaters have been used to prevent hypothermia. But most of them are not totally effective and sometimes cause burns. Administration of amino acids increases protein turnover (breakdown and synthesis) which are energy-consuming processes that produce heat. Therefore perioperative amino acids infusion can induce endogenous heat generation and can reduce perioperative hypothermia and complications (6-9). However, recent review and meta-analysis articles suggested that most of the evidence was almost low quality (10-16). Accordingly, our goal was the evaluation of amino acid infusion on hypothermia (primary outcome) and also shivering (secondary outcome) during surgery under neuraxial anesthesia.

Materials and Methods

Our research is a randomized, double blinded clinical trial that was approved by Mashhad University Ethics Committee and recorded in Iranian Registry of Clinical Trials (NO: IRCT20170429033680N5). After approval by the instituational Ethics Committee, 36 patients who were candidted for elective primary hip arthroplasty, were chosen in Imam-Reza hospital and enrolled to the study protocol [Diagram 1].

After written informed consent was obtained, patients with ASA class Ⅰ; without coagulation disorders, diabetes mellitus, previous hip surgery, aminoacid sensitivity, surgery lasting more than 4 or less than 2 hours, hyperthermia, chronic glucocorticoid use, high creatinine level were chosen. They have not been receiving any NSAIDs since two days before operation and also any aspirin for seven days. All patients with the same overnight fasting and no premedication were randomly divided into two groups that contained an equal number of patients.

At first, core temperature was measured by tympanic thermometer, the measuring accuracy was ±0.1°C, and the response time of the probes was less than 3sec. The patients were monitored for heart rate and blood pressure. In 18 patients a balanced mixture of 17 amino

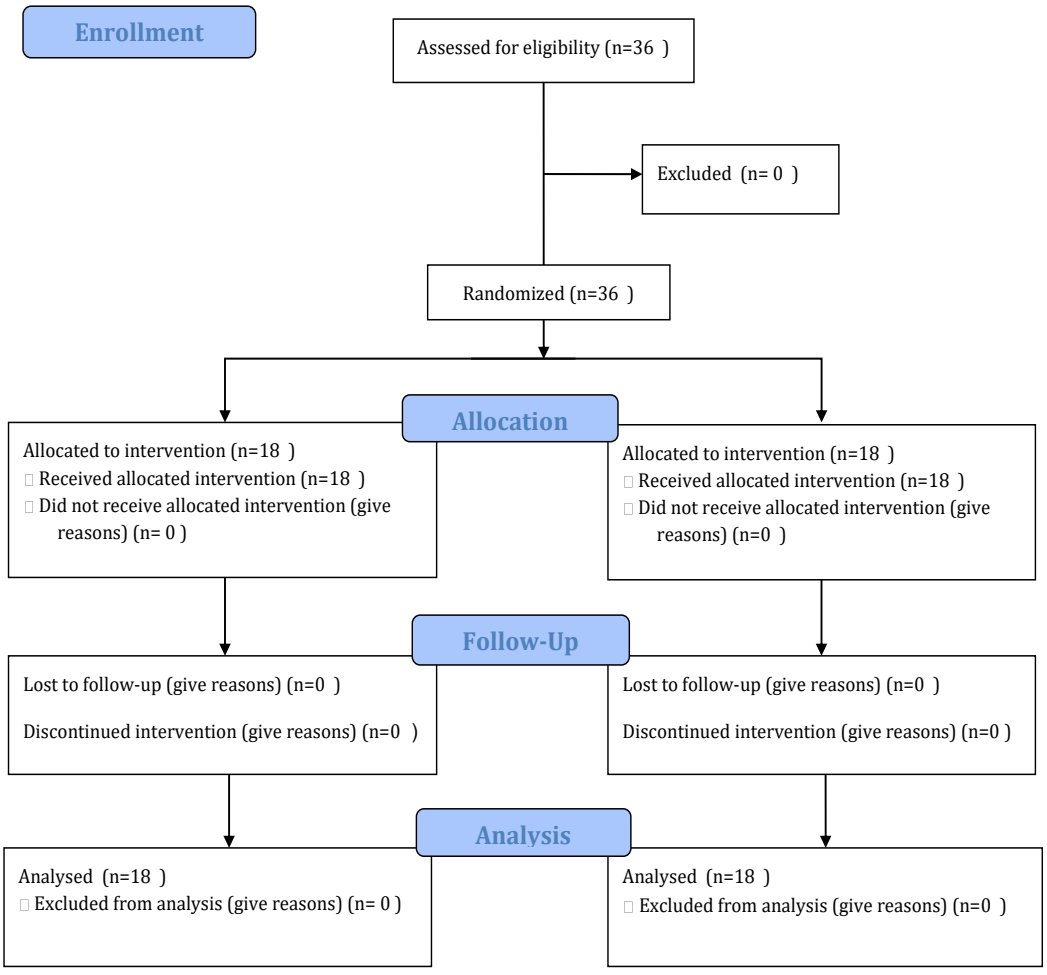

Diagram 1. Consort flow diagram.

acids (Aminoven 10%) was infused from 30 minutes before induction of anesthesia and continued throughout the operation with range of 240 ml/hour up to 500ml. In control group, patients received saline solution same as the other group.

The operating room temperature was maintained at 21-23°C during surgery and all IV fluids were at room temperature except blood (which was warmed if transfusion was necessary). We have used two catheterized cubital veins, one for amino acid or saline solution and the other one for drugs.

All patients had done hip arthroplasty under spinal anesthesia by 16 mg hyperbaric bupivacaine in lateral position. The dermatome level of blockade was recorded each 30 second to maximal block (5min). During surgery, patients' core temperature, heart rate (HR) and mean arterial pressure (MAP) were measured every 10 minutes until the end. Propofol was infused 20 mic/kg/min for sedation. Intraoperative blood loss, operating time and postoperative shivering were recorded. We assessed BUN and serum Cr two times before operation and the day after and patients with Cr>1.5 excluded from study.

Statistical study: Sample size was evaluated by G-power v3 software. With a temperature difference of 0.5oc and ana α error of 5% and a confidence level of 80%, 18 samples were obtained in each group. Data was analyzed with SPSS v18 software. Statistical evaluation of the data was performed by use of simple and paired t-test, chi-square and Mann Whitney tests. Differences were considered significant when P value is less than 0.05.

Results

There was no difference for demographic, preoperative hemodynamic and lab tests in two groups [Table 1]. The baseline core temperature was 36.9°C ± 0.4°C and 36.9°C ± 0.7°C in the amino acids and control groups, respectively (*P=0.07*). Throughout surgery, the mean of MAP and heart rate values in two groups were similar (*P=0.43* for HR and P=0.87 for MAP). In the duration of the study, core temperature decreased from baseline and was significantly different in two groups [Figure 1]. At the end

Table1. dermographic and preanesthesia clinical and paraclinical parameters (mean ± sd)

Variable	control group	Amino acid group	*P-value*
Age (y)	60 ± 17.3	56 ±19.6	0.79
HR (beat/min)	82 ± 14.7	82 ± 21.5	0.56
MAP (mmHg)	91± 15.7	99 ± 11.3	0.2
core temperature (°C)	36.9±0.21	36.9 ±0.44	0.07
Cr (mg/dl)	0.98±0.21	0.87± 0.23	0.84
BUN (mg/dl)	20±6.8	18 ±6.8	0.93

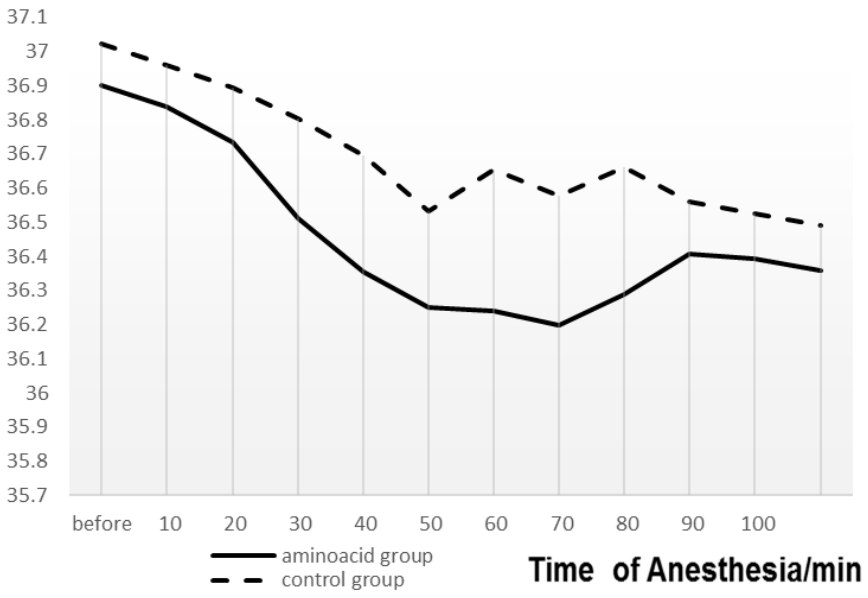

Figure 1. Core Temperature Changes During Anesthesia.

Table 2. Clinical and paraclinical parameters change perioperative surgery (mean±sd)

Variables	control group	Amino acid group	significance
HR (beat/min)	77 ±10.8	82 ±23	0.43
MAP (mmHg)	16 ± 10	16.5 ±13	0.87
Block level	7.9 ±1.3	8.3 ± 0.76	0.27
Blood loss (ml)	452 ±235	473 ± 292	0.77
BUN (mg/dl)	0 ±0.4	2 ±0.3	0.16
Cr (mg/dl)	0.02 ± 0.02	0.02 ± 0	0.91
Recovery time (min)	37.5±3.9	36.7±5.1	0.13
Operation time (min)	106 ±48	99 ± 31.6	0.19

of the study, the core temperature changes were 0.96 ± 0.7°C for controls and 0.94± 0.4°C in the amino acid groups (*P=0.02*).

We have detected postoperative shivering in 5 patients, whom were received amino acids infusion during surgery, against 13 patients with postoperative shivering in controls (*P=0.18*). BUN and Cr do not change during 24 hours at aminoacid vs control group (*P=0.19*).

Discussion

Our study determined thermic effect of amino acids infusion during spinal anesthesia, as previously confirmed during general anesthesia (11, 14, 15). This was reflected by a smaller reduction in core temperature in amino acid group, during surgery.

the anaesthetic agents interfere with thermal regulation. They decrease the metabolic rate, vasoconstriction, the regulatory mechanisms and also alter the shivering threshold. During the first hour hypothermia transfers central heat from the trunk to the extremities due to anaesthesiainduced vasodilatation,.

Hypothermia affects physiological processes and cause cardiac events such as myocardial ischemia, coagulopathy and shivering (14-16). It also increases the risk of wound infections and also delays wound healing. It reduces the flap survival due to flap vasoconstriction, delays extubation and hospital stay (17, 18).

Several devices have been used to control hypothermia in the perioperative period and designed to minimize heat loss (19). All nutrients increase energy expenditure and the amino acids have the highest thermogenic effect. Aminoacid infusion (at 100 mL/h) can reduce intraoperative hypothermia and improves recovery from neuromuscular blockade (20).

This thermic effect is based on nutrient-induced thermogenesis, especially amino acids, stimulates resting energy expenditure and heat production (6, 8, 16).

There were considerable variations from baseline in levels of heart rate and MAP during the spinal anesthesia because of environmental stimulations and personal differences, though there were no significant hemodynamic differences between the two groups throughout anesthesia and surgery. We can introduce, that the thermogenesis effect of amino acids infusion during surgery is occurred without imposing any additional stress in patients (9).

Our findings ,as compared of BUN and serum Cr after operation in two groups, demonstrated the nitrogen excretion was unchanged postoperatively by amino acids-induced thermogenesis during anesthesia .It was the same as the recent studies(21). In this study, shivering in amino acids group was remarkably less than controls, as were showed previously (7).

It has been confirmed, that perioperative amino acids infusion reduced intraoperative blood loss formerly, though we found no difference in intraoperative blood loss between two groups (3, 15). The intraoperative blood loss was estimated by weighing swabs, blood in surgeon field and the contents in the suction bottles, compensating for used irrigation.

Limitations

There were a few limitations. The results of this study cannot be generalized to patients undergoing other surgeries with high heat loss such as abdominal surgeries and low heat loss such as cranial surgeries. Also, hypothermia might be more in patients with poor nutritional status and less muscle mass. Our study was just on spinal anesthesia, However general anesthesia causes more thermal disturbance (22).

In conclusion, amino acids in our study, reduced thermal changes in patients undergoing spinal anesthesia during hip surgery. However, thermal changes in other doses of amino acids, and also surgeries with wider thermal changes such as laparotomy need further evaluation.

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