

Focal hand warming for post-anaesthesia shivering control: A simple and safe non-pharmacological approach in resource limited-area

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ABSTRACT

Post-anaesthesia shivering is a common complication and has multiple deleterious effects. Sometimes multiple non-pharmacological interventions applied together may not control post-anaesthesia shivering adequately, necessitating the use of drugs in some cases. Hand warming is commonly used to warm up the body since time immemorial but its role in preventing post-anaesthesia shivering has not been evaluated. This case series describes the application of this simple and safe method of focal hand warming along with other non-pharmacological measures to suppress post-anaesthesia shivering, whereby possible use of drugs could be avoided.

Keywords: Hand warming, non-pharmacological, post-anaesthesia, post-operative, shivering

Introduction

Post-anaesthesia shivering is a common complication irrespective of the anaesthetic technique and the incidence may be as high as 65–70%.^[1] Shivering has multiple deleterious effects on the body like increased oxygen consumption, lactic acidosis, increased workload on skeletal and cardiac muscle, hypoxaemia, raised intracranial pressure and surgical wound pain, etc. Patients with borderline cardiac reserve may even suffer ischemic events secondary to demand–supply mismatch.^[2] The aetiology of post-anaesthesia shivering is multifactorial and complex which may be thermogenic in majority cases or non-thermogenic

in approximately 15% of the cases.^[3–5] The effect of non-pharmacological methods to control shivering such as electric blanket, forced air warming blanket, warm intravenous fluid, etc. are variable and may require addition of anti-shivering drugs. Commonly used drugs like tramadol, meperidine, dexmedetomidine, etc., may cause nausea, vomiting, sedation, respiratory depression, haemodynamic instability and difficulty in neurological assessment.^[6]

Hand warming is commonly used to warm up the body since time immemorial but its role in preventing post-anaesthesia shivering has not been evaluated. This simple and safe technique of focal hand warming was used in addition to other non-pharmacological methods to suppress post-anaesthesia shivering, which is described in this case series. This technique would be extremely useful for peri-operative physicians working in remote location as it neither requires electricity nor any sophisticated machine.

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Case Series

Case 1

A 35-year-old lady, G₃P₂L₁ was planned for elective lower segment caesarean section under spinal anaesthesia. A 22-gauge intravenous cannula was secured in the left hand and pre-loaded with 500 ml of warm Ringer’s lactate. Monitoring was done using pulse oximeter, non-invasive blood pressure (NIBP) every 3 to 5 minutes, electrocardiograph (ECG) and axillary temperature probe. A dural puncture was done in the intervertebral space of L₃-L₄ with 25-G Quincke’s needle keeping the patient in a sitting position followed by an injection of 2.4 ml of bupivacaine heavy. She achieved a dermatomal block up to the T₄ level and was hemodynamically stable. Intra-operatively, the patient received warm intravenous fluid throughout and a woollen blanket was applied over the non-operative area. A few minutes following the delivery of the foetus she started shivering. She had nausea and vomiting for which tramadol administration could not be considered. At this point, focal hand warming was attempted on the right side, and shivering decreased to grade 1 within two and a half minutes followed by complete disappearance in 6 minutes.

The success of this method in shivering suppression encouraged the author to apply this safe and easy method to other patients.

Technique of hand warming

A saline bottle of 500 ml capacity was warmed to a temperature of approximately 40°C in a bucket filled with warm water. The bottle was used as it is convenient for an adult patient to hold in hand. After measuring the bottle temperature and confirming with bare hands, the saline bottle was handed over to the patient to hold in either of the hands.^[7] When the temperature of the bottle dropped and comes to the skin temperature, as assessed by the clinician, it was replaced by another warm saline bottle. Maximum shivering score at the beginning of hand warming, time to reach score 1 and complete disappearance (score 0) were recorded. The bedside shivering assessment scale was used to grade the severity of shivering [Table 1].

The details of other cases have been described below:

Case 2-20

Irrespective of the type of anaesthesia or surgery, two or more of the following non-pharmacological measures like warm intravenous fluid, woollen blanket and forced air blanket applied over

the non-operative areas were used for prevention of hypothermia intraoperatively. Focal hand warming was applied in these patients when they developed moderate to severe shivering, following either spinal anaesthesia or within 30 minutes of recovery from general anaesthesia (GA). The operation theatre temperature was around 20–22°C. Along with other monitoring devices, the axillary skin temperature was recorded intra-operatively, and the value at the onset of shivering was noted.

The average time taken to reach a shivering score of 1 was 150 seconds while the time taken for shivering to disappear completely was 395 seconds. The values are given in a tabular form below [Table 2]. The patients were observed for at least 30 minutes following complete disappearance of shivering and none of the patients had recurrence of shivering during that period.

Discussion

The mechanism of shivering suppression by focal hand warming is not fully understood. Cutaneous warming decreases the radiant heat loss, prevents redistribution loss and increases overall body heat; however, the shivering suppression by warming of a small area like a hand may not be explained by the above mechanism. Hand warming even worked in some normothermic patients pointing towards a distinct mechanism. The central thermal response is dependent on both mean skin and core temperature. In a non-anaesthetized individual, the temperature threshold for shivering is around 35.5°C of core temperature which decreases during anaesthesia. Skin temperature contributes 20% to the shivering response. Skin temperature contribution to shivering varies depending on the age, gender and different body areas (the upper body contributes more than the lower). Shivering suppression by hand warming may be due to the reduction of the shivering threshold or the effect of warm sensory efferent on the central shivering reflex, which works by sending afferents to activate inhibitory projection neurons in a medial pre-optic area of the hypothalamus.^[8,9]

In our study, two patients had an axillary temperature above 36°C at the beginning of shivering, and this method was also successful in them which indicates that hand warming is effective in shivering suppression irrespective of whether the patient is hypothermic or not pointing towards the possibility of a distinct mechanism different from other warming measures which work by increasing either core or peripheral temperature. Skin temperature, however, may not reflect core hypothermia as the skin-to-core temperature gradient is variable under anaesthesia and is dependent on multiple factors like air velocity, environmental temperature, effect of anaesthetic techniques and perfusion.^[10] Hand warming using a forced air warming unit has been described for control of shivering in un-anaesthetised healthy volunteers during induced hypothermia.^[10] Shivering reverses the benefits of induced hypothermia in stroke survivors where hand or face warming may have a role. However, Doufas *et al.*^[11] found that neither hand nor face warming could effectively reduce the shivering threshold in un-anaesthetised individuals.

Table 1: Bedside shivering assessment scale

Score	Shivering	Patient behaviour
0	None	No shivering noted on palpation of the masseter, neck or chest wall
1	Mild	Shivering localized to the neck and/or thorax only
2	Moderate	Shivering involves gross movement of the upper extremities (in addition to neck and thorax)
3	Severe	Shivering involves gross movements of the trunk and upper and lower extremity

Table 2: Details of surgery, anaesthesia and shivering in all the 20 cases

Sl. No	Age (year)/ Gender	Surgery	Anaesthesia	Intra-operative/ post-operative shivering	Time to grade 1 shivering (in seconds)	Time to grade 0 shivering (in seconds)	Temperature at onset of shivering (°C)
1	19/F	LSCS	SA	Intra-operative	150	352	34.2
2	33/F	LSCS	SA	Intra-operative	96	280	35.1
3	36/M	Left PCNL	SA	Intra-operative	155	370	34.7
4	32/M	Left PCNL	SA	Intra-operative	166	422	35.2
5	38/F	Vaginal hysterectomy	SA	Intra-operative	238	298	33.8
6	29/F	LSCS	SA	Post-operative	188	466	34.8
7	23/F	LSCS	SA	Post-operative	230	380	34.7
8	25/F	LSCS	SA	Intra-operative	204	367	34.8
9	50/F	Left PCNL	SA	Intra-operative	164	506	36.2
10	62/F	Left PCNL+URSL	SA	Post-operative	122	396	34.3
11	20/F	LSCS	SA	Intra-operative	105	426	34.2
12	62/F	URSL	SA	Intra-operative	62	340	36.1
13	27/F	Ovarian cystectomy	GA	Intra-operative	160	428	35.1
14	26/F	LSCS	SA	Intra-operative	202	390	34.8
15	36/F	LSCS	SA	Intra-operative	130	430	34.4
16	33/F	Diagnostic Hystero-laparoscopy	GA	Post-operative	162	380	34.9
17	33/F	LSCS	SA	Post-operative	136	410	34.5
18	25/F	LSCS	SA	Intra-operative	122	410	33.8
19	30/F	LSCS	SA	Intra-operative	98	382	34.8
20	34/F	LSCS	SA	Post-operative	112	466	34.9

M=male, F=female, LSCS=lower segment caesarean section, URSL=ureteroscopic lithotripsy, PCNL=percutaneous nephrolithotomy, SA=spinal anaesthesia, GA=general anaesthesia

We applied focal hand warming in awake patients undergoing regional anaesthesia or post-operatively in GA patients using a warm saline bottle that does not require electricity or any costly equipment and can be extremely helpful in resource limited setup. This case series neither establishes the efficacy nor the superiority of focal hand warming over other available methods. A randomized controlled trial comparing the commonly used non-pharmacological interventions and drugs in terms of shivering control, time taken for disappearance of shivering, thermal comfort and recurrence rates may be helpful.

Conclusion

Focal hand warming may be tried in moderate to severe post-anaesthesia shivering control due to its simplicity and safety along with other available non-pharmacological methods, especially in resource limited setup. However, its efficacy, onset of action and recurrence rate need to be compared with other shivering control measures.

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Conflicts of interest

There are no conflicts of interest.

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