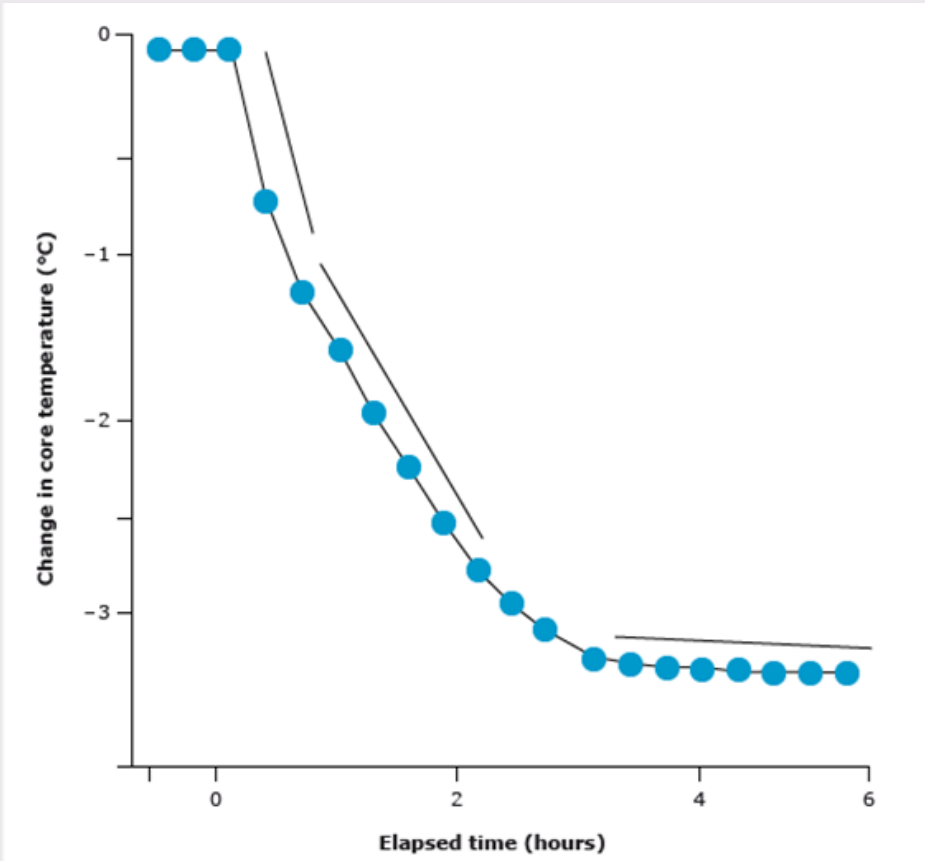


Introduction

Perioperative hypothermia is defined as a temperature less than 36°C. The incidence of which has been reported to be between 20-90%. Even mild (34-36°C) hypothermia can have detrimental perioperative complications. Only 11% of patients in low- and middle-income countries (LMIC) are actively warmed, while 35% become hypothermic when surgery is longer than 2 hours. Intraoperative heat loss follows a distinctive triphasic pattern, however, this does not consider patient specific risk factors. There is a paucity of literature regarding the incidence of perioperative hypothermia in emergency surgery.

Figure 1 – Triphasic pattern of intraoperative hypothermia



Our aim was to identify the incidence of perioperative hypothermia in patients presenting for emergency surgery in a regional hospital.

Method

After departmental approval, we performed a single operator, prospective audit. Convenience sampling of all patients undergoing emergency surgery requiring general or regional anaesthesia over 6-months or first 100 patients. Tympanic temperature measurements were taken prior to induction and on emergence. Patients were managed with routine care. Demographic data collected; age, gender, ASA classification, type of surgery and anaesthesia, start time and use of a forced-air warmer (FAW) were recorded in a password protected Microsoft Excel book.

The primary outcome was any perioperative hypothermia. Secondary outcomes were incidence of preoperative hypothermia, degree of hypothermia and presence of a FAW in hypothermic cases.

Data is presented as numbers, percentage, mean, median or interquartile range.

Results: outcomes

Figure 5 - Measured tympanic temperature at emergence

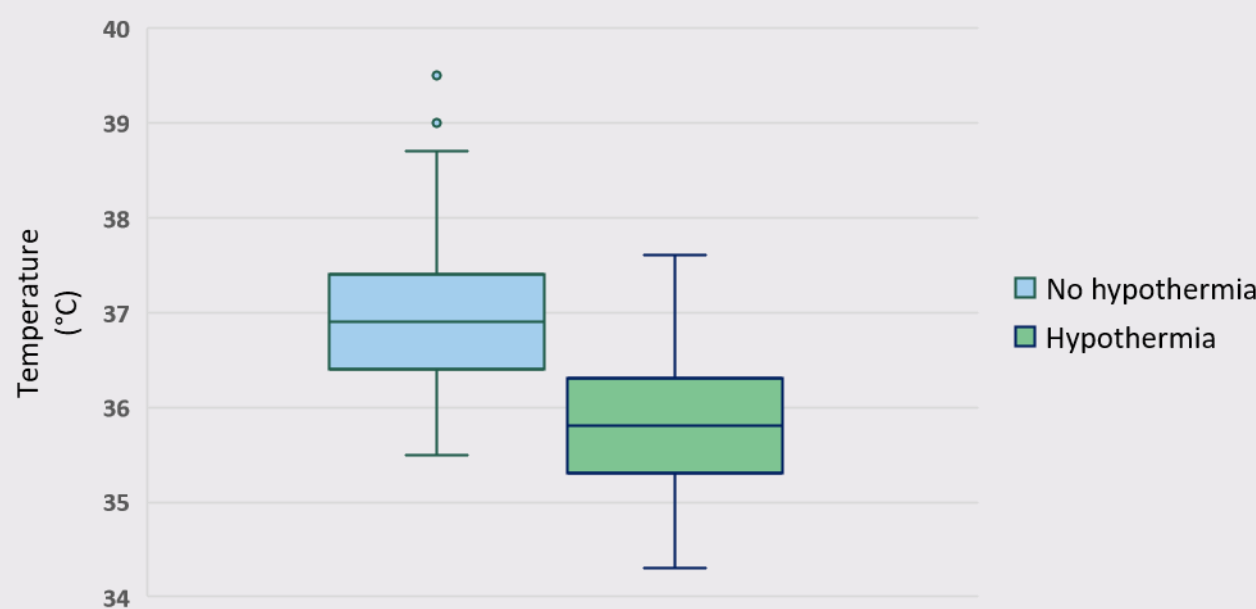
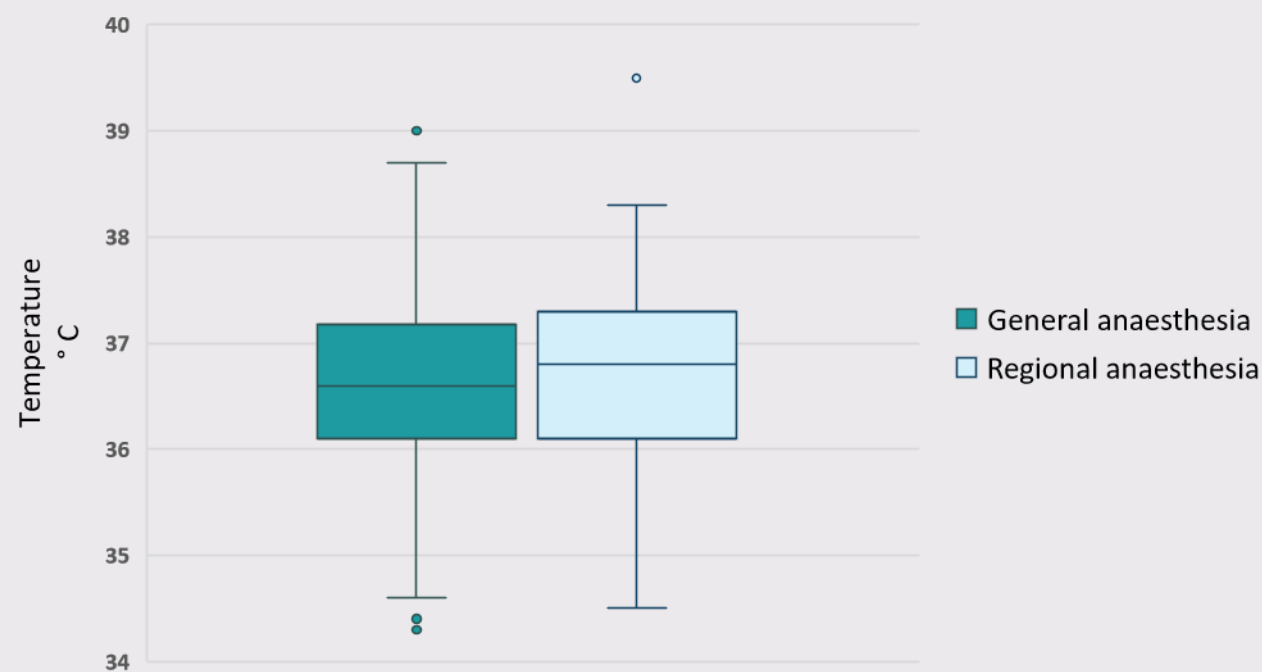


Figure 6 - Temperature for type of anaesthesia



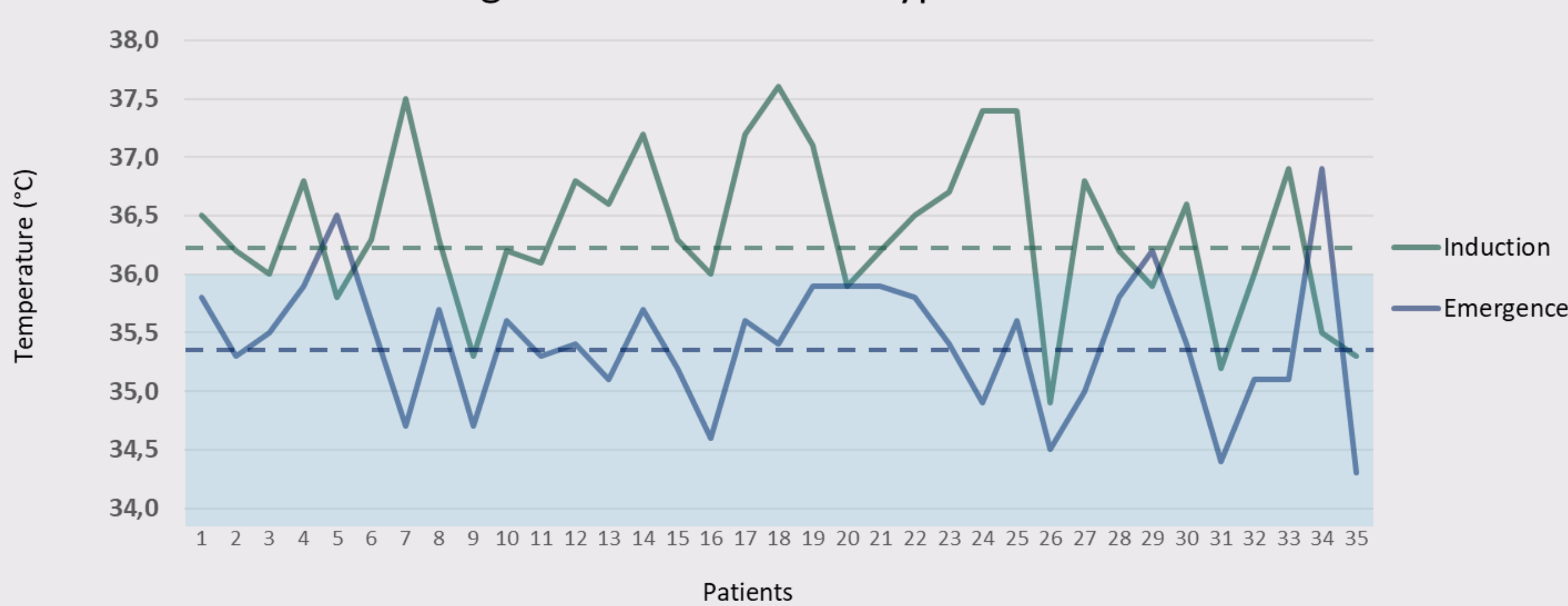
37% Overall incidence of hypothermia

7% Preoperative hypothermia
63% remained hypothermic

Mild All cases of perioperative hypothermia were 34-36°C

93% Hypothermic patients who had a FAW

Figure 7 - Incidence of hypothermia



On emergence

56% of hypothermic patients had a temperature below 35,5°C

Overall, **17%** of all patients had a temperature below 35,5°C

Results: demographics

Figure 2 - Flow diagram of patients presenting to theatre for emergency surgery

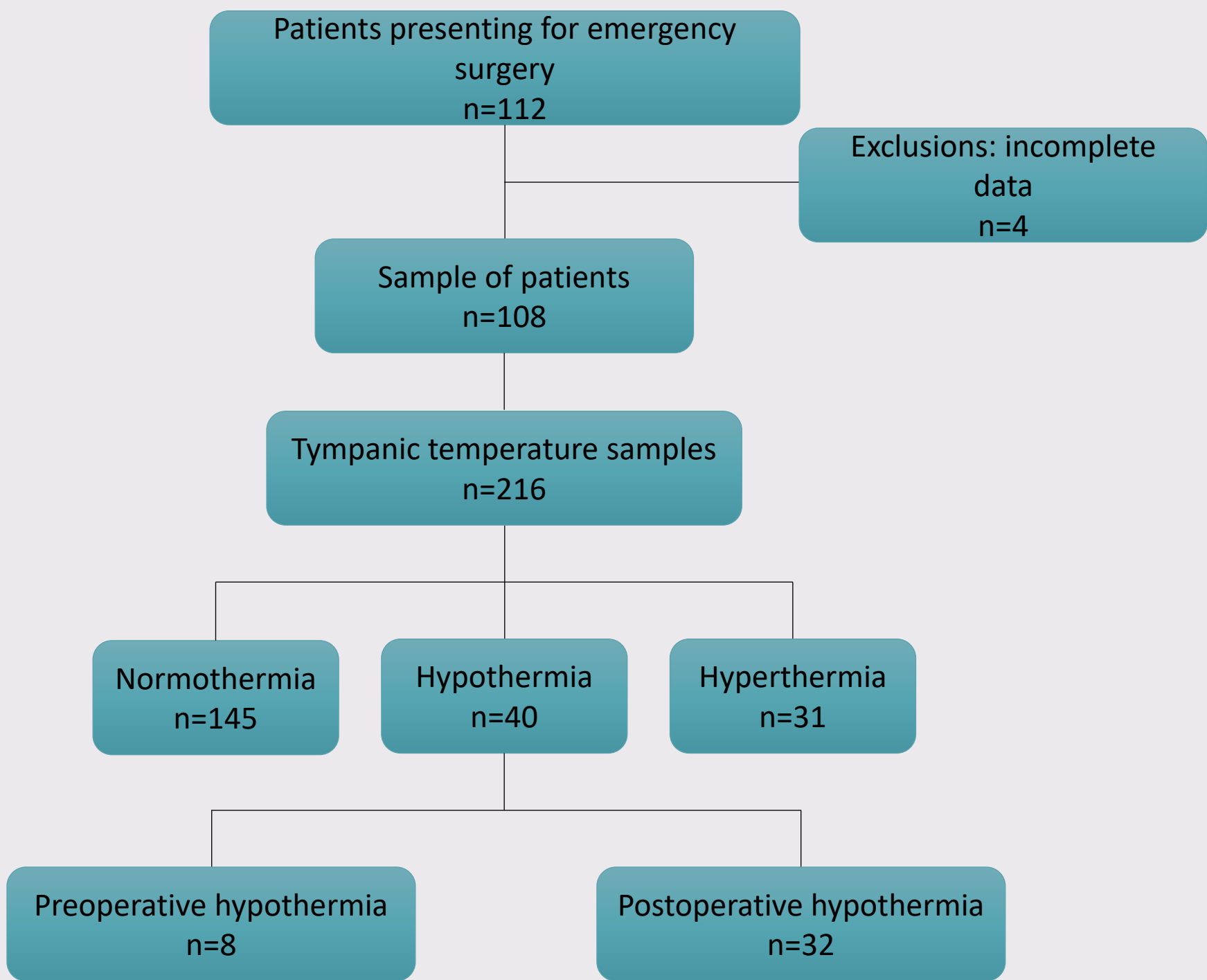


Table 1 – Patient demographics

	Total	Hypothermia	No hypothermia
Tympanic Temperature, median, (SD)			
Measured, °C	36,7 (0,9)	35,8 (0,8)	36,9 (0,7)
Intraoperative change, °C	-0,6 (0,9)	-0,9 (0,8)	-0,4 (0,7)
Gender, n, (%)			
Female	46/108 (42,6)	14/46 (30,4)	32/46 (69,6)
Age, n, (%)			
<16 years old	9/108 (8,3)	2/9 (22,2)	7/9 (77,8)
17-59 years old	83/108 (76,9)	30/83 (36,1)	53/83 (63,9)
>60 years old	16/108 (14,8)	3/16 (18,8)	13/18 (81,2)
ASA Classification, n, (%)			
I	17/108 (15,7)	6/17 (35,3)	11/17 (64,7)
II	74/108 (68,5)	23/74 (31,1)	51/74 (68,9)
III	15/108 (13,9)	4/15 (26,7)	11/15 (73,3)
IV	2/108 (1,9)	2/2 (100)	0/2 (0)
Case Duration, n, (%)			
30 min - 1 hour	18/108 (16,7)	5/18 (27,8)	13/18 (72,2)
1 - 2 hours	68/108 (63)	23/68 (33,8)	45/68 (66,2)
>2 hours	22/108 (20,3)	7/22 (31,8)	15/22 (68,2)
Timing of Surgery, n, (%)			
Before midnight	93/108 (86,1)	31/93 (33,3)	62/93 (66,7)
After midnight	15/108 (13,9)	4/15 (26,7)	11/15 (73,3)
Anaesthetic Technique, n, (%)			
General anaesthesia	60/108 (55,6)	19/60 (31,7)	41/60 (68,3)
Regional anaesthesia	47/108 (43,5)	16/47 (34)	31/47 (66)

Figure 3 - Intraoperative temperature change

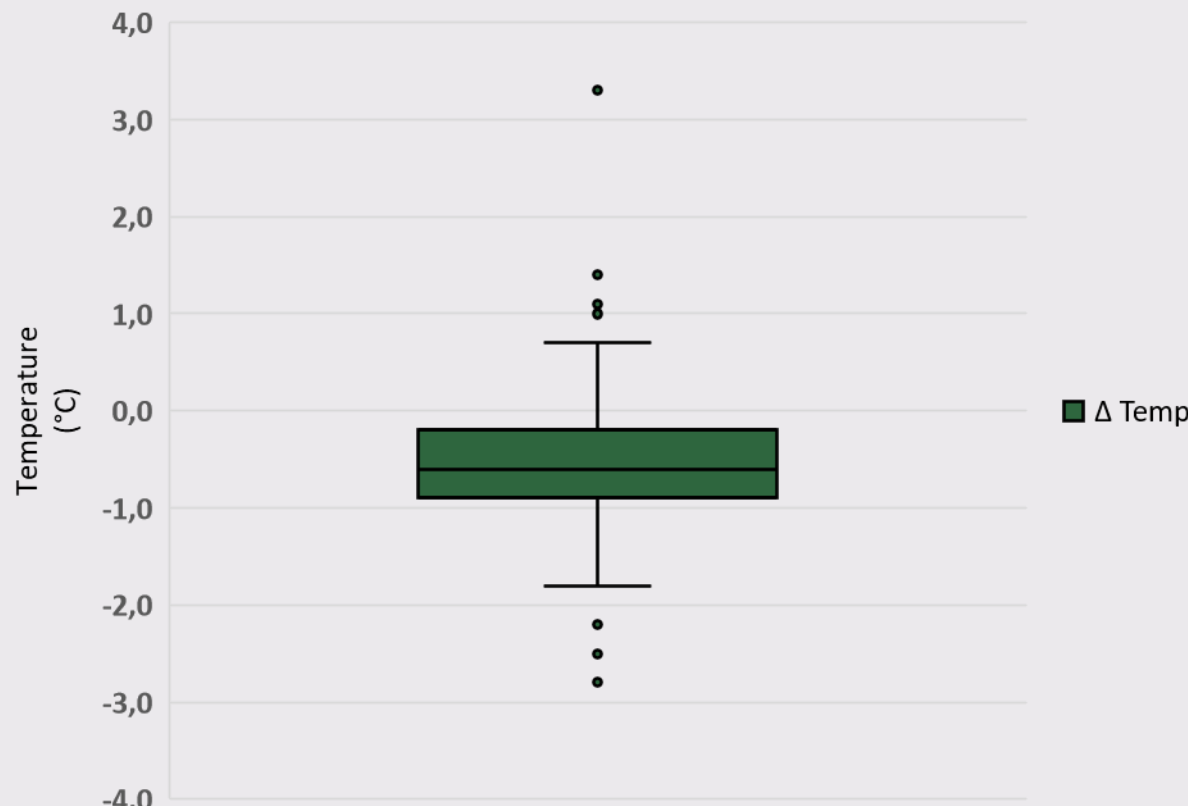
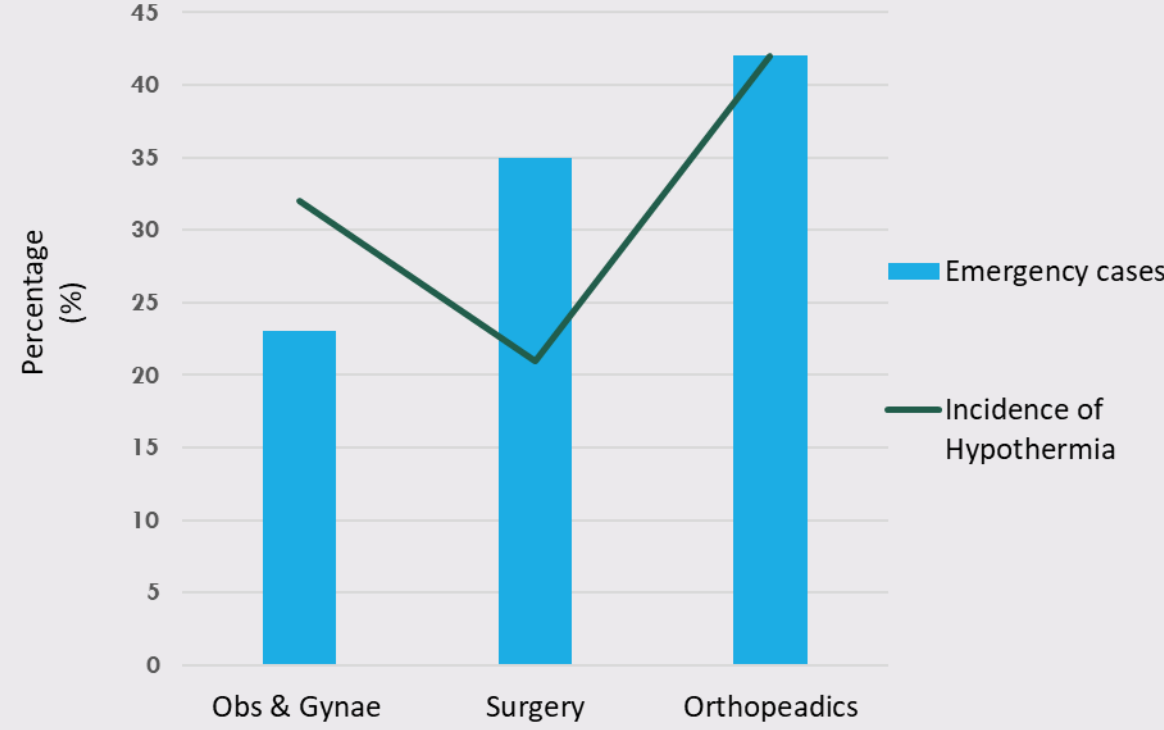


Figure 4 –Surgical discipline and incidence of hypothermia



Discussion

Hypothermia was common in patients presenting for emergency surgery in our regional hospital and is in keeping with local and international literature. However, all cases of hypothermia were mild with a minimum of 34,3°C and a median of 35,4° C (SD 0.5°C). Recent evidence from a large RCT showed that there was no difference in major cardiovascular outcomes in patients randomised to receive routine temperature care (35.5°C) and aggressive warming (37°C). However, further evidence indicates that temperatures near 34,5°C may increase perioperative risk.

Preoperative hypothermia is a risk factor for perioperative hypothermia. An increased temperature gradient between core and peripheral tissues exists and is exacerbated by induction of anaesthesia which decreases the threshold for autonomic thermoregulatory responses, induces vasodilatation and further redistributes heat from core to the peripheral tissues. Therefore we noted that despite intraoperative temperature management, redistribution hypothermia continues.

Other risk factors include ASA II-V, combined general and regional anaesthesia technique, low BMI, extremes of age, long duration, major and emergency surgery and hemodynamic status.

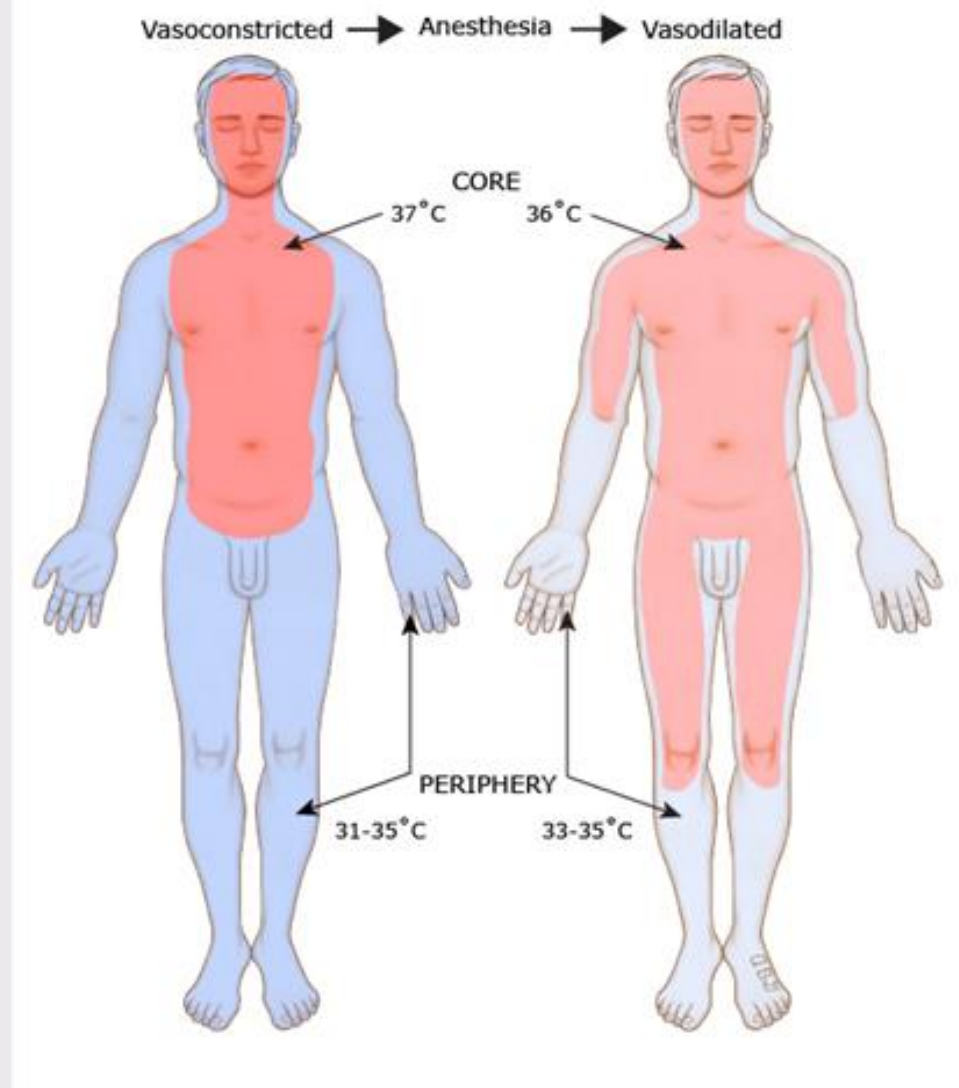


Figure 8 – Heat flow from core to peripheral compartment

In our study, the incidence the incidence of hypothermia was similar in most patient demographic categories. Notable exceptions were in patients under 16 years old and ASA IV patients. Significantly, orthopaedic patients experienced the highest rate of hypothermia.

This study has limitations. Temperature measurements were taken with a tympanic thermometer. The tympanic membrane temperature correlates well the hypothalamic temperature. Tympanic thermometers correlate within 0.5°C of other thermometers measuring core temperature. Tympanic thermometers are prone to error due to poor technique and subsequent measurement of the aural canal skin. Measurement is also affected by debris in the ear canal. However, the use of a tympanic probe was guided by acceptability, practicality and reproducibility in theatre considering that it was used in patients receiving both general and regional anaesthesia. Secondly, this study was a single operator audit with a small sample size. Finally, regional anaesthesia included both neuraxial and peripheral nerve blocks.

Conclusion

Our study showed that all patients are at risk of developing hypothermia perioperatively in the setting of emergency surgery and that even actively warmed patients are at risk of developing hypothermia.

Clinically, we will aim to maintain our patients core temperature at 36°C. Increased vigilance and a tailored approach to each individual patient may help to identify and manage perioperative hypothermia effectively. Although all hypothermic incidences were mild, 1 in 5 of all patients presenting for emergency surgery are at increased risk for perioperative complications.