

SHIVERING

The impact of shivering

Shivering can cause multiple challenges in patient management. Sustained and vigorous shivering can increase metabolic heat production up to 600% above basal level¹ and can double or even triple oxygen consumption,² breathing effort, and heart rate. Heat production makes cooling itself much more difficult, and in certain cases cooling devices can no longer cope with the body temperature and patients cannot be cooled.³ You need a system that efficiently manages the patient's temperature from the core, like ZOLL's Thermogard XP® (TGXP).

Shivering:

- Is counter-productive to the efforts of cooling⁴
- Results in longer cooling time to reach target temperature⁵
- Can decrease the ability to maintain target temperature precisely⁵
- Requires the use of more paralytics⁶

Intravascular temperature management therapy results in a lower rate of shivering (4% vs 85% with surface)^{7, 8} than other methods of cooling.



¹Popovic R, et al. *Anesthesiology*. 2000;92:5:1343-49.

²Dempsey RJ, et al. *Neurosurg*. 1987;21:2:177-181.

³Clifton GL, et al. *Neurology*. 2010;10:2:131-139.

⁴Doufas AG, Wadhwa A, et al. Neither arm nor face warming reduces the shivering threshold in unanesthetized humans. *Stroke* 2003;34:1736-1740.

⁵Mayer SA, Sessler DI, eds. *Therapeutic Hypothermia*. New York: Informa Healthcare; 2005: 293-321.

⁶Lord, AS, et al. *Neurocrit Care*. 2014;21:2:200-206.

⁷Diringer MN, et al. *Critical Care Medicine*. 2004;32(2):559-564.

⁸Carhuapoma JR, et al. *Journal of Neurosurgical Anesthesiology*. 2003;15(4):313-318.