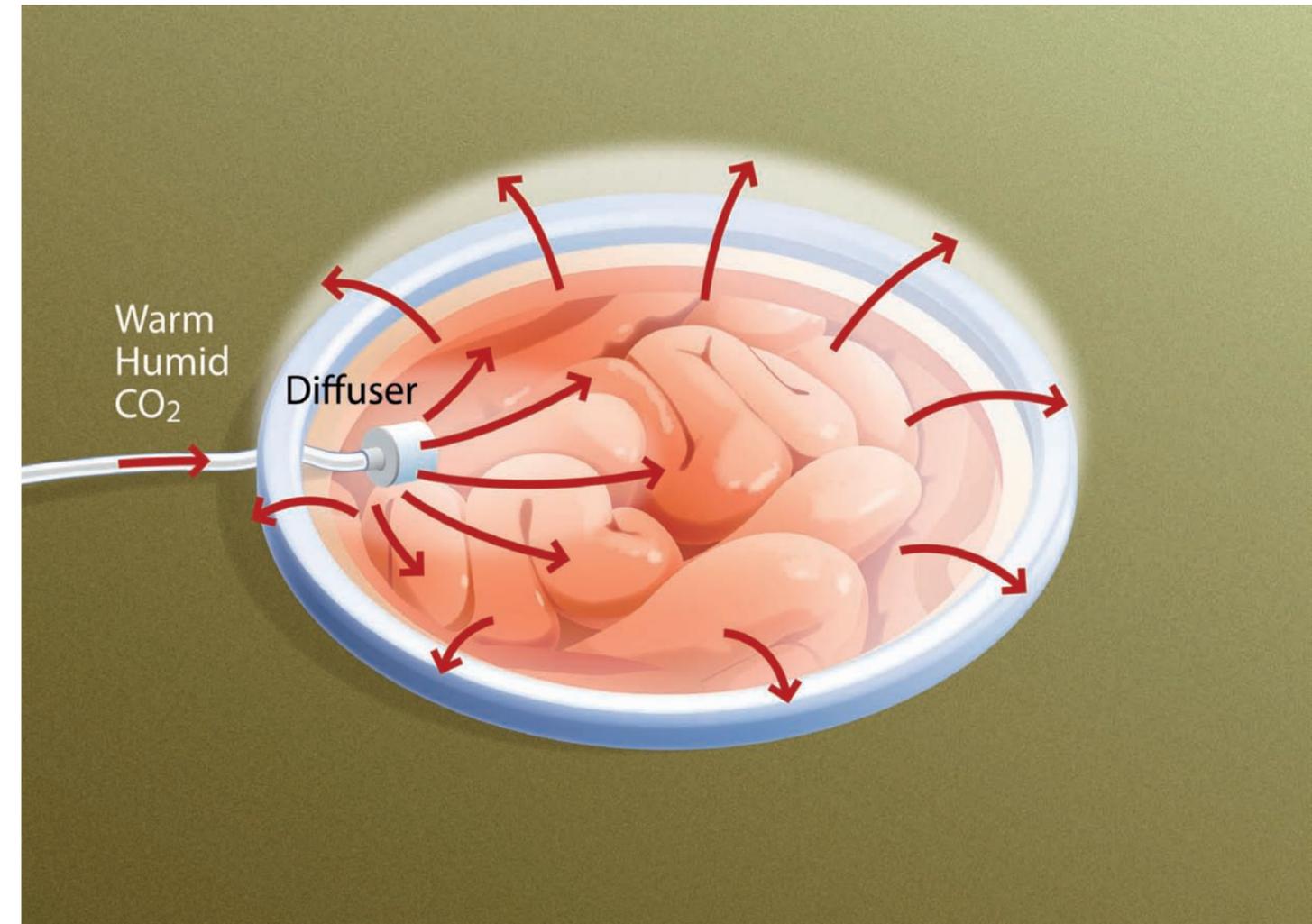


References

1. Kurz A, Sessler DI, Lenhart R. Perioperative normothermia to reduce the incidence of surgical-wound infection and shorten hospitalization. Study of wound infection and temperature group. *N Engl J Med* 1996;334:1209-15.
2. Sheffield CW, Sessler DI, Hopf HW, M. S, Moayeri A, Hunt TK, West JM. Centrally and locally mediated thermoregulatory responses alter subcutaneous oxygen tension. *Wound Rep Reg* 1996;4:339-45.
3. Hopf HW, Hunt TK, West JM, Blomquist P, Goodson 3rd WH, Jensen JA, et al. Wound tissue oxygen tension predicts the risk of wound infection in surgical patients. *Arch Surg* 1997;132:997-1004.
4. Persson M, Elmkvist H, van der Linden J. Topical humidified carbon dioxide to keep the open surgical wound warm: the greenhouse effect revisited. *Anesthesiology* 2004;101:945-9.
5. Persson M, van der Linden J. Wound ventilation with carbon dioxide: a simple method to prevent direct airborne contamination during cardiac surgery? *J Hosp Infect* 2004;56:131-6.
6. Persson M, Svenarud P, Flock JI, van der Linden J. Carbon dioxide inhibits the growth rate of Staphylococcus aureus at body temperature. *Surg Endosc* 2005;19:91-4.
7. The practice committee of the American Society for Reproductive Medicine. Pathogenesis, consequences, and control of peritoneal adhesions in gynecologic surgery. *Fertil Steril* 2008;90:S144-9.
8. Binda MM, Molinas CR, Koninckx PR. Reactive oxygen species and adhesion formation: clinical implication and temperature during laparoscopy on adhesion formation in mice. *Fertil Steril* 2006;86:166-75.
9. Ryan GB, Grobety J, Majno G. Mesothelial injury and recovery. *Am J Pathol* 1973;71:93-112.
10. Nkere UU, Whawell SA, Sarraf CE, Schfield JB, Thomson JN, Taylor KM. Perioperative histologic and ultrastructural changes in the pericardium and adhesions. *Ann Thorac Surg* 1994;58:437-44.
11. Persson M, van der Linden J. Intraoperative CO2 insufflation can decrease the risk of surgical site infection. *Med Hypotheses* 2008;71:8-13.
12. Ott D. Desertification of the peritoneum by thinfilm evaporation durin laparoscopy. *JSLs. Sep* 2003;7(3):189-195.
13. Erikoglu M, Yol S, Avunduk MC, Erdemli E, Can A. Electron-microscopic alterations of the peritoneum after both cold and heated carbon dioxide pneumoperitoneum. *J Surg Res. May* 2005;125(1):73-77.
14. Peng Y, Zheng M, Ye Q, Chen X, Yu B, Liu B. Heated and humidified CO(2) Prevents Hypothermia, peritoneal Injury, and Intra-Abdominal Adhesions During Prolonged Laparoscopic Insufflations. *J Surg Res. Apr* 23 2008.
15. DeWilde R, Trew G, on behalf of the Expert Adhesions Working Party of the European Society of gynaecological E. Postoperative abdominal adhesions and their preventions in gynecological surgery. Expert consensus position. *Gynecological Surgery. 2007;4(3):161-168.*
16. Parker MC, Wilson MS, van Goor H, Moran BJ, Jeekel J, Duron JJ, et al. Adhesions and colorectal surgery – call for action. *Colorectal Dis* 2007;9 (Suppl.2):66-72.
17. Ellis H, Moran BJ, Thomson JN, Parker MC, Wilson MS, Menzies D, et al. Adhesion-related hospital readmissions after abdominal and pelvic surgery: a retrospective cohort study. *Lancet* 1999;353:1476-80.
18. Ray NF, Denton WG, Thamer M, Henderson SC, Perry S. Abdominal adhesiolysis; inpatient care and expenditures in the United States in 1994. *J Am Coll Surg* 1998; 186: 1-9.

Optimal wound climate during open surgery



CarbonVITA™ tissue protector

cardia
I N N O V A T I O N

Cardia Innovation AB
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Patent# US6494858B1, 6994685B2, 7549973B2,
Patent# Europe 1032322, 1239915, Patent#
Sweden515473,

cardia
I N N O V A T I O N

When the surgeon opens the surgical wound he abruptly exposes the tissues to a totally new environment, ambient air, which is characterized by:

Lower temperature

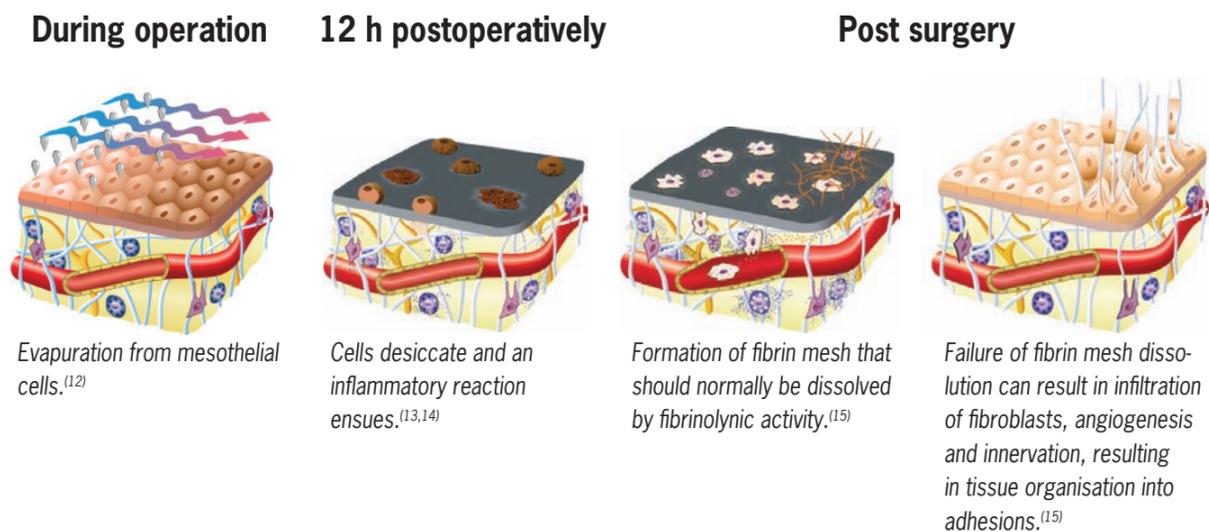
Even a mild hypothermia increases the risk of wound infection⁽¹⁾ partly due to a decreased tissue blood flow and tissue oxygenation.

and, probably even more important,

Far lower humidity

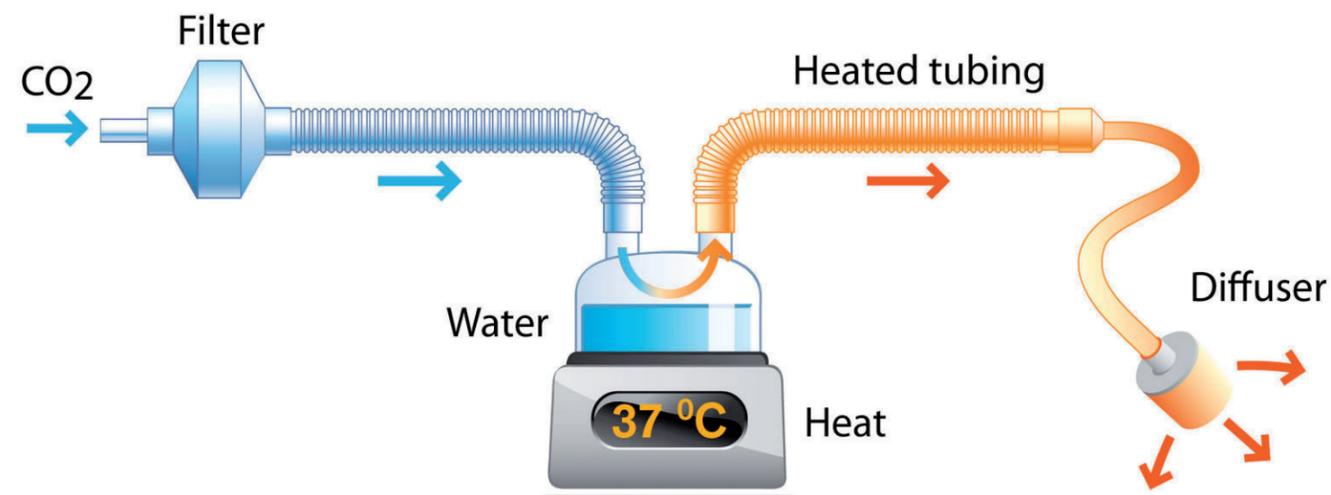
Perioperative desiccation of superficial tissue in the surgical cavity is recognized as one of the most important adhesiogenic factors^(7,8). The desiccation of mesothelial cells activates an inflammatory process which in the end leads to adhesion formation^(7,8).

Climatic change during operation and adhesion formation



Postoperative adhesion formation is claimed to be the most frequent complication in abdominal surgery⁽¹⁶⁾ where as much as one third of the patients have to be readmitted for conditions related to adhesions⁽¹⁷⁾. The economical impact of adhesions is therefore also huge. In the United States alone the annual adhesion-related expenditures in healthcare exceed one billion dollars⁽¹⁸⁾.

CarbonVITA™ tissue protector functional diagram



Intraoperative field flooding with warm humidified CO₂ can decrease the occurrence of adhesions after open surgery.

Flooding the surgical cavity with warm CO₂ will not only prevent airborne bacteria from reaching the exposed tissue⁽⁵⁾ but also suffocate those already there⁽⁶⁾. Moreover, the use of heated humidified CO₂ will also keep the surgical wound tissue warm⁽⁴⁾, which in its turn optimizes the immune system against infection⁽¹⁻³⁾. Thus, decreasing the risk of surgical site infection and its toxic effects should also imply a reduced risk of adhesion formation.

Potential application areas for the CarbonVITA™ tissue protector

- All open surgeries, including
- Abdominal surgery
 - Cardio thoracic surgery
 - Orthopedic surgery