Substitution of Formaldehyde in Cross Anatomy Is Possible

The recent publication by Hauptmann et al. (1) in the Journal provided clear evidence for increased mortality from cancer induced by exposure to formalin, as outlined by The Final Report on Carcinogens Background Document for Formaldehyde of the National Toxicology Program (2). Hauptmann’s data, along with a report by Viegas et al. (3) demonstrating that medical students are exposed to formalin concentrations greater than 5 ppm during macroscopic examinations, have caused medical institutions to reconsider the use of formalin to fix and preserve cadavers and tissues. The emerging data indicating the toxicity of formalin have resulted in the closure of German dissecting rooms in medical schools and could potentially result in poor gross anatomy training and strongly affect the quality of medical staff education. A recent complaint by surgeons that a lack of knowledge in anatomy is already prevalent among young doctors (4) indicates that the development of new nontoxic fixatives are necessary to allow medical students to adequately study gross anatomy in a safe environment.

To address this problem, the Institute of Anatomy at Universität Leipzig has developed an approach to conserve human cadavers for dissection courses with the use of a fixative consisting mainly of ethanol and glycerin. This room temperature 1.5% glycerin solution is perfused through...
the femoral artery of cadavers at 1 L/kg of body weight. After perfusion, the cadavers are immersed in ethanol for 3 weeks to conserve the outer surface. The cadavers can be packed in polyethylene foil and stored at 5°C for at least 3 years without signs of decomposition. In contrast to formalin fixation, which indurates tissues, ethanol–glycerin fixation maintains a great amount of flexibility allowing for joint movement, thus improving access to various regions of interest (eg, axilla and perineum) during anatomical preparation. Conservation of the musculoskeletal system in ethanol- and glycerin-fixed cadavers is comparable to that in formalin-fixed cadavers, and tissue colors are better preserved, allowing easy distinction between nerves, arteries, and veins (Figure 1, A). Also, the ethanol–glycerin fixative is superior to formalin for the preservation and visualization of the viscera (Figure 1, B and C) and small organs such as the suprarenal and the parathyroid gland. The superiority of ethanol–glycerin fixation in regard to tissue maintenance has led our institution to abandon the use of formalin in dissection courses (360 students) and in operation courses for clinicians (approximately 50 courses). Whereas the potentially carcinogenic effect of formalin has been discussed for decades without clear instructions for medical institutions regulating its use, the data provided by Hauptmann et al. (1) in the Journal have caused staff in a variety of fields to re-evaluate their safety regulations. The re-emergence of this issue will not necessarily endanger the medical education in gross anatomy but could provide a chance to move on to better and safer modes of tissue fixation. We have found that formalin can be substituted by ethanol–glycerin to fix cadavers, thereby resulting in specimens of better quality and avoiding any adverse effects on the health of those exposed to the fixed tissues. We are certainly open to demonstrate our fixation technique and its results to representatives of any institution interested in continuing anatomical dissection for medical education and advanced training in a safe environment.

References

Notes
Affiliation of authors: Institute of Anatomy, Universität Leipzig, Leipzig, Germany (NH, SL, CF, IB, HS).
Correspondence to: Ingo Bechmann, MD, Institut für Anatomie, Universität Leipzig, Liebigstr. 13, Leipzig04103, Germany (e-mail: ingo.bechmann@medizin.uni-leipzig.de).
DOI: 10.1093/jnci/djr035
© The Author 2011. Published by Oxford University Press. All rights reserved. For Permissions, please e-mail: journals.permissions@oup.com.
Advance Access publication on February 14, 2011.