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## Editorial

# The use of formalin for embalming cadavers: A need for alternatives

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Within the discipline of anatomical education, the use of donated human cadavers in laboratory-based learning activities is often described as the 'gold standard' resource for supporting student understanding of anatomy.<sup>1</sup> Embalming leads to a long-term preservation of structure with minimal shrinkage and distortion of tissue and also prevents over-hardening. The most common chemical used for this purpose is Formaldehyde which has been used as a fixative in anatomy.<sup>2</sup>

Exposure to formaldehyde fumes gives rise to various toxic effects in anatomists, embalmers and medical students. The acute effects are irritation of upper respiratory tract and eyes, lacrimation, burning of nose and throat, and contact dermatitis while the chronic effects include carcinogenicity and mutagenicity.<sup>3</sup> The top three most common acute adverse effects of formaldehyde during dissection of a cadaver in the cadaver hall were unpleasant smells, tiredness/dizziness, and watering of eyes (lacrimation). Despite the adverse effects, formaldehyde is still used for the preservation of cadaver because of its low cost and effectiveness. Moreover, the majority of medical students and anatomy staff members do not wear personal protective

equipment (PPE) such as face masks, eye goggles, and gloves in the anatomy dissection hall. These make us more vulnerable to the acute adverse effect of formaldehyde vapours in the dissection hall.<sup>4</sup>

The development of formalin-free fixatives is an urgent issue in gross anatomy because of the health hazard and the tissue-hardening actions of formalin. N-vinyl-2-pyrrolidone (NVP) solution can be used as an alternative to formalin in human cadaveric dissection. NVP is a precursor of the water-soluble macromolecular polymer polyvinylpyrrolidone. The NVP-embalmed corpses showed no sign of decomposition or fungal growth. The bodies remained soft and flexible. The range of motion of most joints was greater in the NVP-fixed than formalin-fixed cadavers. The abdominal wall and the visceral organs remained pliable and elastic, resembling those of fresh cadavers.<sup>5</sup>

The impact of four embalming solutions on the tissues of human cadavers has also been studied. To this end, a formalin-based solution, Thiel, Genelyn and Imperial College London soft-preservation (ICL-SP) solution were compared. Thiel embalmed cadavers showed an increase in range of motion while ICL-SP cadavers remained relatively the same. Genelyn and formalin embalmed cadavers

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registered a notable decrease in range of motion. The investigation into the impact of the embalming chemicals on the dimensions of internal organs and vessels revealed that Thiel embalming technique leads to a decrease in the dimension of the cardiovascular system. Formalin is necessary to retain shape and size of the organs and vessels investigated in this study.<sup>6</sup> Thiel-embalmed cadavers, which have been adopted for use in anatomy teaching in relatively few universities, show greater flexibility and color retention compared to formalin-embalmed cadavers, properties which might be considered advantageous for anatomy teaching.<sup>7</sup> Thiel embalming method offers good quality cadavers that are soft, flexible; tissue colour closer to natural state and without is strong formalin smell and structures can easily be identified.<sup>8</sup>

Another study says that an excellent alternative to formalin is phenoxethanol. In their experience pheno-xetol proves to be a viable replacement of formaldehyde. Its efficacy as a preservative and fixative is supposed to be better than formalin. In addition to avoiding the well-known hazardous effects of formaldehyde, the use of phenoxetol also prevents the pungent and irritating smell associated with formalin and other local and systemic manifestations of its toxicity. It is simple to use and adds only a small contribution to the overall cost of preservative. At present initial fixation of cadavers is being done with formalin. It is recommended that initial fixation may also be slowly replaced and done with phenoxetol.<sup>9</sup>

Since there are a number of health hazards related to the use of formalin, the time has come when we can think of some useful alternatives to it.

### Conflict of Interest

None.

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