

Brief Report**Methods of cadaver preservation used in Sri Lankan medical faculties; Merits and Demerits.**¹Udhayakumar S, ¹Anaath AMS¹Department of Anatomy, Faculty of Medicine, University of Jaffna**Abstract**

Anatomy is a fundamental education for healthcare professionals in understanding the structure and function of the human body. Cadavers - human bodies donated for scientific study - have been crucial for students and researchers to examine the three-dimensional structures and relationships within the body that cannot be taught by textbooks or digital models alone. Several techniques are employed to preserve cadavers. This article focuses on formalin fixation and phenoxy ethanol glycerine, the two most common practices used in Sri Lankan medical schools. This helps anatomy educators and embalmers to choose the right procedure with minimal exposure to hazardous chemicals.

Key Words

Cadaver Embalming, Formalin, Phenoxy ethanol glycerine, Sri Lankan medical schools.

Introduction

According to recent statistics – In Sri Lanka, 1200 doctors are graduating each year from 11 state medical universities and one Defence University (1). Sri Lankan medical universities use cadavers as an anatomical tool to further understand the structures and relations of the human body by allowing students to carry dissections on their own or using prosected specimens. The practice of dissection allows students worldwide including in Sri Lanka to get adapted to their emotional attitudes, build discipline and skills that are essential requirements of modern health care setup (2). Cadaveric dissections help students realize the value of human life and supply a realistic image of what to expect in future patients. Therefore, it is essential to preserve cadavers, which refers to the process of chemically treating human dead bodies to reduce the growth of microorganisms, delay organic decomposition and maintain acceptable physical state (3).

Human bodies have been preserved since ancient time for several reasons such as religious belief, long distance transportation of the body and reasons unknown (4). However, anatomical preservation refers to the preservation of the human body for scientific study, research and to teach anatomy for medical students (5). One of the most crucial factors to consider when using human remains in educational contexts is maximal preservation of cadavers from decomposition, putrefaction and damage (6). While several techniques such as plastination, Thiel preservation, phenoxy ethanol glycerine embalming and more are being discovered recently, formalin fixation remains to be the most common worldwide and Sri Lanka is no exception (7, 8). Some Sri Lankan medical schools have started embalming their cadavers using phenoxy ethanol glycerine as an alternative. This article aims to highlight the commonly used two above mentioned preservation techniques, method used in each Sri Lankan medical schools and advantages and disadvantages of the two techniques in hopes that the universities can identify and select the best preservation technique.

Formalin fixation

Formalin – the commercially available form of formaldehyde – acts as a preservative by penetrating and reacting with the cadaveric tissue proteins to form cross-linked product, which resist putrefaction and autolysis for an extended period (8). This method involves injecting embalming fluid [with the composition of 40 % formalin (2.5 - 4 litre), ethanol (1 – 2.5 l), glycerine (1.5 – 2.5 l), phenol 5 (ml) and water to make it to 8 litre mix], into the vascular system commonly via femoral artery (or internal carotid artery) under high pressure until froth comes out of the natural orifices. After embalming, the body is kept outside for 2 days before dipping in the cadaver tank. Cadavers can be

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used for dissection after three months of embalming. Formalin is known to be an excellent tissue fixative (4) preventing cellular degradation, which aids in accurate histological examination. As an antiseptic (4), formalin ensures the quality of cadavers by inhibiting microbial growth and reducing the risk of contamination during the preservation process. In addition, formalin's ability to tan cadaveric tissues without destroying delicate structures (4) is highly advantageous as well. From an economic standpoint, formalin is a cost-effective (9) choice. It's affordable, available, bio-degradable, small amount is can preserve large amount of tissue and has a long shelf life (8).

While the protein crosslinks allow tissue fixation, they cause rigidity, resulting in joint stiffness (4, 8). It is reported that formalin dehydrates tissues and causes discoloration (8). Formalin has a characteristic unpleasant pungent odor (4, 8) which often causes nausea (2) resulting in many students developing a sense of fear and disgust towards dissection sessions. Irritating odour also induces coughing, watery and burning eyes.

In recent times, several researches have concluded formalin to be a carcinogen (4, 6, 8, 9). Chronic exposure to formaldehyde is found to cause contact dermatitis, peeling and irritation to the skin and allergic reactions (4). Reproductive disorders such as menstrual problems, anaemia and congenital deformities have been linked to exposure to formalin as well (8).

Phenoxy ethanol (PE) glycerine embalming / “Crosado” technique

Phenoxy ethanol glycerine embalming protocol was developed as an alternative to replace formaldehyde technique in cadaver preservation (10). PE is also used to wash out excess formaldehyde from cadavers (4). Although PE glycerine is merely a preservative – not a fixative – it supplies a broad range of antimicrobial activity (4). This allows it to be the ideal preservative to demonstrate movements around joints (9) as they don't stiffen as in formalin preservation. PE retains the colour of the cadaver, maintains soft tissue consistency and is comparatively non-toxic as it uses reduced hazardous chemicals in the embalming fluid (6). The fruity odour of PE glycerine is preferred by students compared to

formaldehyde (9). In addition, it can be easily used in any facility as it does not require the cadavers to be dipped and kept in tanks. The embalmed cadavers are packed in plastic bags and closed with a zip to prevent evaporation of chemicals and attack by creatures and kept in racks.

However, the higher price of PE compared to Formalin fixation and need of large amount of chemical are considerable disadvantages (8). Further, the demerits of PE glycerine are being researched actively. Although contact allergy to PE has been rarely reported despite its widespread use, one case of immediate hypersensitivity reaction has been reported (9). Perceived learning outcomes of histology sections obtained from PE embalmed tissues were significantly inferior compared to formaldehyde-based tissues (10).

Preservation methods used in Sri Lankan Medical schools

All Sri Lankan Medical schools used to preserve cadavers via the formalin fixation method until recently as some universities have shifted towards the phenoxy ethanol glycerine embalming technique. Majority of universities including University of Peradeniya, Ruhuna, Jaffna, Rajarata, Sabaragamuwa, Kelaniya, Wayamba and General Sir John Kotelawala Defence University are employing the formalin fixation method to preserve cadavers in their Anatomy departments. However, General Sir John Kotelawala Defence University has planned to start cadaver preservation by PE embalming soon. But once the cadavers are taken out from the tanks, duration of keeping them out before dipping again into tank differ between faculties. Climate also plays a role on it. Some faculties maintain cadavers in dissection trollies for months. Once the cadavers are outside, body fluid, which has glycerine (wetting agent) as its main composition, is applied to cadavers / cadavers are wrapped with rugs dipped in body fluid. Antifungal recipe (phenol with glycerin) is used to apply to bodies, if there is a fungal contamination.

University of Colombo and Sri Jayawardenepura have adopted the PE glycerine embalming technique for cadaver preservation. Since University of Moratuwa and Eastern University does not have required cadaver

preservation facilities, they are supplied cadavers from other Universities. In addition, Eastern University has a virtual dissection table, too.

Conclusion

The choice of cadaver preservation method in medical schools of Sri Lanka reflects the continuous efforts to balance out cost, effectiveness, and safety. Formalin Fixation, employed by majority of universities remains a widely adopted and established technique. However strict adherence to safety measures is required to minimize its unpleasant and harmful effects of it. In addition, measures has to be taken to do regular monitoring of formaldehyde concentration in air (formalin index) to ensure the acceptable concentration in the dissection hall. On the other hand, PE Glycerine Embalming is getting popular as an attractive alternative to formalin-based preservation.

While both methods serve to enhance medical education, it is up to the institution to identify the best option by evaluating the pros and cons of each. As medical education continues to evolve, shifting to a more innovative, ethical, and sustainable preservation method will ensure a robust learning experience for aspiring healthcare professionals in Sri Lanka.

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