A Review Article on Modern Techniques of Human Body Preservation

Pradnya Nerlekar[1], Manoj Jagtap[1]
[1]Department of Rachana sharir, Yerala Ayurvedic Medical College , Kharghar, Navi Mumbai.

Corresponding Author:
Pradnya Nerlekar
E-mail: pra001nerlekar@gmail.com

Submission: 19.05.2025 Acceptance: 19.06.2025 Publication: 30.06.2025

Abstract :-

Anatomy is the knowledge about the structure of the bodies of animals and people. This includes information about blood vessels, organs, the skeleton, and nerves, etc. For the Study of anatomy, theoretical and practical knowledge is important to understand the body. Dissection is the base of practical knowledge of human anatomy for medical students and Acharya Sushruta was the first physician and surgeon who dissected a human dead body in the ancient era.

For dissection of the dead body preservation with a good method is necessary. In the modern era, dead body preservation is done with the prepared solution of various chemicals. This process is called embalming. Embalming is the treatment of the dead body with antiseptics and preservative chemicals by way of vascular and a cavity injection to prevent putrefaction and preserve the body.By this process proteins are coagulated, tissues are fixed, organs are bleached and hardened. Embalming produces a chemical stiffening similar to rigor mortis, and normal rigor does not develop.Embalming rigidity is permanent. With the help of embalming process, Decomposition of body is inhibited for many months. The ingredients that can be made used for making up human embalming fluids are: formalin, phenol, methylated spirit, water and Glycerin.

In this paper we have discussed the different methods of preservation of dead bodies in detail along with the new advances.

Keywords :- Embalming process, Decomposition , Preservation and Dead body.

Introduction:- For the dissection of the dead body, preservation with a good method is necessary. In the modern era, dead body preservation is done with the prepared solution of various chemicals. In Ayurveda, Acharya Sushruta has described about the scientific method of preservation and dissection. Extreme cold rivers slow flowing water, Bambu cage, Munja, Kusha (Dharbha), chhal(valkala) ,and shan , these are the preservative material were use by the Acharya Sushruta for the preservation of the dead body.[(1)] Preservation of dead body can be done by mummification, preservation in ice, refrigeration, plastination and embalming etc. It's the science of human body to treat it with chemical components for preservation of dead body by preventing microorganisms such as bacteria and fungi which are classified as main causes of organic decomposition which lead to putrefaction.[(2)] Embalming is an ancient art established by old Egyptians.[(3)] It is used in many purposes such as transportation of dead body from place to another place as religious practice in some countries etc. Embalming causes the coagulation of tissue proteins that get fixed and hardened. The three goals of embalming are thus preservation, sanitization and presentation or restoration of a dead body to achieve this effect. In this study we will focus on preservation of dead body for anatomy education. Most of faculties of medicine around the world use the body cadaver for teaching anatomy for medical student and for research, and this type of preservation is called anatomical preservation.[(4)]

Types of preservation

1. Natural Preservation

This type of preservation occurs by natural factors including freezing and dryness that may occur by dry-heat or dry-cold and the soil.[(5)] The body or body parts preserved by this can be called the naturally mummified one.

2. Preservation in cold/ice (Refrigeration)

This is a natural form of preservation of the dead body in which the body is kept in a very cold atmosphere.[(6)]

3.Mummification

Mummification is the preservation of a cadaver. It was Egyptians who developed the process of Mummification.[(7)] Some mummies are preserved wet, some are frozen, and some are dried. It can be a natural process or it may be deliberately achieved. The Egyptian mummies were made by drying the body. By eliminating moisture, you have eliminated the source of decay. They dried the body by using a salt mixture called natron. Natron is a natural substance that is found in abundance along the Nile river. Natron is made up of four salts: sodium carbonate, sodium bicarbonate, sodium chloride, and sodium sulfate.[(8)] The sodium carbonate works as a drying agent, drawing the water out of the body. At the same time the bicarbonate, when subjected to moisture,

increases the pH that creates a hostile environment for bacteria. The Egyptian climate which is both hot and dry, encourages and favors the process of mummification to take place ".

It can be divided according to the causative agents which cause preservation of dead body. They are:

A) **Natural mummification:** This is caused by the Nature which occurs when buried in and climate conditions.[9]

B) **Artificial mummification or true mummification:** This is the type of preservation that had been done by Ancient Egyptian civilization for religious concepts.[10] Different materials had been used in the mummification include materials that desiccate and dehydrate such as natron salt and vegetable materials and those act as anti-bacterial factors such as Mastic, Lichen, Myrrh, Bitumen, Cassia, Onions, Beeswax, Lichen, Coniferous resin, Henna and Gum Arabic.[11]

Features of mummification:-

It begins in the exposed parts of the body like face, hands and feet and then extends to the entire body including the internal organs. The skin may be shrunken and contracted, dry, brittle, leathery and rusty-brown to black in colour, stretched tightly across anatomical prominences, such as the cheek bones, chin, costal margins and hips, adheres closely to the bones, and often covered with fungal growths. As the skin contracts, some of the fat cells in the subcutaneous tissues are broken, and the liquid oil is forced into the dermis which becomes translucent. The entire body loses weight up to 60 to 70%, becomes thin, stiff and brittle. In mummified bodies, arms are often abducted in the shoulder joints, flexed in elbow joints and hands are clenched into fists in most cases. This flexion is often seen in lower limbs also. This is due to shrinkage of muscles and tendons. Mummification may be partial in some cases, with only limbs or head or trunk being affected.

Mummified tissues are dry, leathery and brown in colour. The internal organs become shrunken, hard, dark-brown and black and become a single mass.

As mummified body is practically odourless.

4. Plastination

Plastination is a technique or process used to preserve bodies or body parts.[12] This technique was established by German scientist Gunther von Hagens in laboratory of Heidelberg University in 1977.[13] The main advantage of this technique of preservation that the specimens were dry, durable, odorless, handleable and storable manner.[14] In the process of plastination the fluids and lipids in biological tissues substitute by curable polymers commonly epoxy, silicone and polyester. As a result of this procedure the specimen gets harden , do not smell or decay, look natural and even retain most properties of the original sample and the prevent decomposition which lead to putrefaction of biological tissues. The institute maintain three international centres of plastination: in Germany, Kyrgyzstan and China.[15]The University of Vienna has its own plastination laboratory.[16]

Process of plastination

In the standard process of plastination following four steps are involved: Fixation, dehydration, Forced impregnation in a vacuum, and hardening.

Water and lipid tissues are replaced by curable polymers.

Curable polymers used by plastination include silicone, epoxy and polyester-copolymer.[17]

1) Fixation is the process which involves utilisation of formaldehyde based solution. Formaldehyde or other preservative solutions help prevent the decomposition of the tissues. They may also confer degree of rigidity. This can maintain the shape or arrangement of a specimen. . The specimen is then placed in a bath of acetone.
2) Under freezing conditions, the acetone draws out all the water from the cells.[18]
3) In the third step, the specimen is then placed in a bath of liquid polymer, such as silicone rubber, polyester or epoxy resin. By creating a vacuum, the acetone is made to boil at a low temperature. As the acetone vaporizes and leaves the cells, it draws the liquid polymer in behind it, leaving the cell filled with liquid plastic. The plastic must then be cured with gas, heat, or ultraviolet light, in order to harden it.[19]A specimen, which can be anything from a full human body to a small piece of an animal organ are known as “plastinates'
4) Once plastinated, the specimens and bodies are further manipulated or positioned prior to hardening of the polymer chains.[20]

As previously described, many chemicals can be used to replace the fluid and fat this led to provide different techniques of plastination here are some of this techniques:-

a) Silicone plastination

Silicone plastination is one of most common techniques of plastination which can be used for body, organs, part of organ and slices.[21] This technique was invented by Gunther von Hagens in 1970.[22] The Plasti-nation techniques depend on vacuum of original body or tissue fluid and replace it by special curable polymer of the standard silicone S-10.[23] The fixative chemical mostly use is formaldehyde. A Silicone plastination consist of

four steps after preparation of specimen and are dehydration, defatting, hardening and formaldehyde embalming or fixation.

b) Epoxy plastination

This techniques of plastination is usually used for tissue examination especially slices of 2 - 4 mm.[24] The techniques of preservation are similar to Silicone plastination and it substitutes of all water and most of lipid with curable resin.[25] The result of epoxy plastination is durable sectional slices looking like magnetic resonance Image and computed tomography so it suitable for studying anatomy at gross or macroscopic to the microscopic level.

The chemicals which are used in (generic) epoxy plastination technique and Biodur™ E12 sheet epoxy plastination technique are the same which include:[26]

- Fixatives (if necessary)
- Methylene chloride (MeCl) as defatting agents
- Acetone
- Epoxy resin
- Epoxy hardeners to link the epoxy molecules
- Epoxy plasticiser

c) Polyester plastination

The basic steps in this technique are also the same as described in the earlier procedure. In Polyester plastination the tissue fluids withdrawn and replaced bycurable Polyester resin[27] such as P40 as described by von Hagens [17), or P35 resin that has been used by von llagens or the new comer P45 resin as described by Gao, H. This method is suitable to study the anatomical formation of 4 - 8 mm slices of nervous tissue.[27] The basic steps in polyester plastination technique are preparation of specimen, slicing and dehydration. The chemicals used according to Sargon, M.F.include the following:

- fixatives (if necessary)
- acetone
- methylene chloride (if necessary)
- polyester resin.

Uses of plastination

1. Plastination is useful in anatomy education as well as serving as It is use as models and tools for teaching purpose.[28]

2. Plastination allows students to have hands on experience in this field, without exposure to chemicals such as formalin.

3. The plastinated specimens retain their dilated conformation by a positive pressure air flow, which allows them to be used to teach both endoscopic technique and gastrointestinal anatomy.[29]

Uses of Plastination as a Method of Preservation of Dead Bodies

Plastination of soft tissues, organs, bones and teeth has proved valuable in preserving delicate, friable and calcined specimens. The dry, odourless and biological inert specimens are durable and resistant to damage caused by frequent handling.

Patterned injury may change due to shrinkage, but remain easily recognizable.

In Medico-Legal cases, these specimens may be used for accurate identification and preservation of important material.' Body preservation method current to the 21" century is cryopreservation.

Cryopreservation is a process where cells or whole tissues are preserved by cooling to low sub-zero temperatures, such as (typically) 77 K or "196 °C (the boiling point of liquid nitrogen). At these low temperatures, any biological activity, including the biochemical reactions that would lead to cell death, is effectively stopped. However, when vitrification solutions are not used, the cells being preserved are often damaged due to freezing during the approach to low temperatures or warming to room temperature.

5 .Embalming

Embalming is the process of preserving a human body by delaying decay. The embalming includes the use of chemicals in order to slow down the process of decomposition.[2] Embalming involves the use of fixative. Embalming fluid is introduced into the cadavers, through the arterial system to prevent putrefaction. Formaldehyde is the chemical that is used as the main embalming chemical now. It is a colourless solution that maintains the tissue in its lifelike texture and can keep the body well preserved for an extended period. The three major goals of embalming are preservation, sanitization, presentation and restoration of a dead body. nowadays in modern culture it become substantial science and art due to social and science reason because the preserved body cadaver considered as an ideal teaching tool for anatomy and other branches medical science such as surgery, obstetrics, pathology and radiology.[5]

a) Embalming in the ancient cultures

Many ancient cultures including Egyptian culture practiced embalming as they believed that decayed dead of the body would preclude it from life after death.[30] The basic steps of ancient embalming are:

1) Washing surface and body cavity with palm wine.
2) Removal of brain and internal organs (viscera) and keep it in jars except the heart.

3) Left the internal organ to dry.
4) Cover body with natron salt to dry.
5) After 40 days the body is wash with wine and spices.
6) Return back the organs inside the body.
7) Wrapped the body with linen.
8) Place the body inside coffin.

b) Modern embalming

As the body cadavers are very important in anatomical studies, the embalming for preservation of dead body became more important. The actual embalming process usually involves four parts:

1. Arterial embalming:- This involves the injection of embalming chemicals into the blood vessels, usually via the right common carotid artery. This is to replace the body fluid by embalming solution. The embalming solution is injected through a mechanical pump and the embalmer massages the corpse to ensure a proper distribution of the embalming fluid. In case of poor circulation, other injection points are used.[4]

2. Cavity embalming, :- This involves suction of the internal fluids of the corpse and the injection of embalming chemicals into body cavities, using an aspirator and trocar. The embalmer makes a small incision just above the navel and pushes the 30 cm long trocar in the chest and stomach cavities to puncture the hollow organs and aspirate their contents. He then fills the cavities with chemicals that contain formaldehyde. The incision is either sutured closed or a "trocar button" is screwed into place.In cavity embalming, gas and fluid in the organ and inner side of the body replaces with embalming fluid using a trocar.[31]

3. Hypodermic embalming :- This involves, the injection of embalming chemicals under the skin as needed. This is a complementary step to ensure that embalming fluid reach all parts of the body, especially to those sites of body where the arterial fluids might not reached. This is done by using hypodermic needle.

4. Surface embalming:- This is a treatment for damaged area in the surface which may occur due to a lot of causes such as skin diseases, cancer, decomposition or other epidermal injury.[31]

Procedure of Embalming (Arterial Embalming):-

Firstly, the cadaver is washed with antiseptic soap and warm water.

1. The dead body is lying in the supine position on the dissection table in the dissection hall,
2. The subject is usually placed on anatomical position on a flat surface
3. Rigor mortis, if present should be broken by bending, massaging, rotating the head, etc.
4. The nostrils are cleaned and plugged with a wad of cotton soaked in arterial solution. The cheek may be filled out with cotton soaked in arterial solution. The mouth should be closed. The eyelids should be closed. If the eyeball is sunk arterial solution should be injected into the orbit and eyeball.
5. The head should be elevated 8 to 10 cm. and placed on a head rest, and the feet raised to facilitate drainage.
6. The anal orifice should be plugged with cotton wool soaked in cavity fluid. The vagina should be plugged similarly.
7. There are four possible sites for inserting the perfusing cannulae. These are both femoral and common carotid arteries.
8. If blockage of one of the arteries prevents a satisfactory flow of fluid into the body then the other are tried in turn.[32]
9. In femoral artery embalming, On the right or left side, inguinal ligament lies between the anterior superior iliac spine and the pubic tubercle. Make the incision less than 4 cm below it. The lateral side of the femoral sheath contains the femoral artery, whereas the medial side contains the femoral vein. The dead body is preserved by sending preservative fluid in body through the femoral artery.
10. A single-point injection often leaves patches of areas unfixed by the embalming fluid. Multiple sites of injection may be required in cases of traumatic death, autopsied cases and postmortem mutilations.
11. The 'six-point' injection involves right and left common carotid arteries for the head and neck, right and left axillary arteries for the upper limbs and the right and left femoral arteries for the lower limbs.
12. All drainage points should be ligated after completion to prevent a leak.

Embalming Chemicals

Different types of the chemicals are the components of embalming fluid. These are:

1. Preservatives: These are the chemicals which inactivate saprophytic bacteria rendering it unsuitable media upon which such bacteria thrive. This arrests decomposition by altering enzymes and lysins of the body.

These are a mixture of formaldehyde, glutaraldehyde and phenol. Formalin refers specifically to 37% aqueous formaldehyde.

2. Germicides (disinfectants): Chemicals used to kill microorganisms e.g. quaternary ammonium compounds (Roccal, Zephiran Chloride) and glutaraldehyde.

3. Modifying agents: These include buffers, humectants and inorganic salts. These agents influence the chemical reactions produced by preservative solution and function in embalming fluids to control the action of main preservative agents.

4. Buffers: They help to maintain acid base balance (pH) e.g. Borax, Sodium

phosphate, Citrates and Sodium salt of EDTA (Ethylene diamine tetra acetic acid)

5. Inorganic salts: They play an important role in determining the osmotic qualities of embalming solution.

6. Humectants: they are used to hydrate the tissues e.g. Glycerol (Glycerine), Sorbitol, Glycol (Ethylene and Propylene glycol) and Lanolin.

7. Anticoagulants: They retard the natural postmortem tendency of blood to become more viscous e.g. sodium citrate, sodium oxalate and sodium salt of EDTA (Chelate).[33]

8. Surfactants: These are the chemicals that reduce the molecular cohesion of a liquid so that it may flow through smaller apertures e.g. Sulfonates (alkyl sulfonates or alkyl aryl sulfonates and sodium Lauryl sulfate).

9. Dyes (coloring agents): they impart a definite color to the embalming solution e.g. Eosin, Ponceau Red, Erythrosine and Amaranth.

10. Perfuming agents/Masking agents/ Deodorants: they reduce the harshness or raw odour of the solution e.g. Benzaldehyde, Oil of cloves, Oil of Sassafras, Methyl Salicylate.

11. Vehicles (Diluents): liquids that serve as a solvent for the numerous ingredients that are incorporated into embalming fluids e.g. water, alcohols (methyl alcohol, glycerol).'

A typical embalming fluid:-

A body weighing 70 kg will require a fluid equivalent to ten litres (box):-[34]

Ingredients	Proportion
Formalin (Preservative)	1.5 l
Methanol (Preservative)	500 ml
Phenol (Germicide)	50 ml
Thymol (Fungicide)	5 gm
Sodium borate (Buffer)	600 gm
Sodium citrate (anticoagulant)	900 gm
Glycerin (Wetting agent)	600 ml
Sodium chloride (control pH)	800gm
Eosin(1% cosmetic)	30ml
Soluble wintergreen (Perfume)	90ml
Water (Vehicle)	Up to 10L

Physical characteristics of body cadavers after embalming

By keeping cadaver in formalin will cause a 50% stenography in energy absorption and raise the rate of bone crispness. Mechanical integrity will de- crease after embalming due to bone demineralization . Anatomically embalmed cadavers have a typically uniform grey colouration due both to the high formaldehyde concentration and to the lack of red colouration.[3]

Importance of embalming

Temporarily preserve human remains to forestall decomposition and make it suitable for display at a funeral. Embalming for anatomical research and study. The cadavers are always very well fixed so that they can be used for not only anatomical dissection but also research for the vascular system by venography, kinematics of the joint and other histologic examinations.

Today, cadavers are used in medicine and surgery to increase knowledge of gross human anatomy. .Surgeons dissected and examined living patients who died before surgical procedures to detect possible abnormalities in the surgical area of interest.

New types of surgical procedures can cause many procedural obstacles that can be removed with prior knowledge of dissection. For this proper preservation of cadaver is important

Discussion:-

Cadavers are important for the understanding of body science and medical student often use cadavers for study anatomy and for the dissection.Cadavers are often used to verify surgical techniques before moving

on living patients. Due to this, proper Preservation of dead body is must for dissection. Ayurveda and modem science both describe the different preservation method.In Ayurveda, method of preservation is simple and natural. In ayurvedic method no chemical is used for preservation but in modem method of preservation many chemical agent are used. Embalming fluids act to fix a cellular protein, which means that it cannot act as a nutrient source for bacteria and it also kills the bacteria themselves. Additionally, embalming restores the body to an acceptable physical appearance for display at a funeral and anatomical exhibition. Modern embalming is not done with singular fluid; rather various different chemicals are used to create a mixture called an arterial solution which is generated specifically for the need of each case.

Conclusion:-

Embalming in most modern cultures is the art of temporarily preserving

Human remains to retard decomposition and make it suitable for display at a funeral and important of all a science of preserving human body for anatomical research and study.

In the present scenario, modern techniques of the embalming process are used.

Knowledge of anatomy and dissection is necessary for surgical, radiological, histological, and clinical, research and improves the healthcare system's point of view by producing new scientific data. For this proper preservation of cadaver is important.

Source of Support: Nil

Conflict of Interest: Nil

References :-

1. Choudhary D, Sharma M, Jyotsna, Bishnoi K. Ancient Ayurvedic and modern method of preservation of dead body. World J Pharm Med Res. 2017; 3(8):55-7.
2. Frederick, L.G. and Strub, C.U. (1989) The Principles and Practice of Embalming. 5th Edition, Professional Training Skills Inc. & Robertine Frederick, Dallas, TX, 1- 487.
3. Batra, A.P.S., Khurana, B.S. and Kaur, N. (2010) Embalming and Other Methods of Dead Body Preservation. International Journal of Medical Toxicology & Legal Medicine, 12, 15-19.
4. Ikeda, A., Fujimoto, K., Yoshii, I., Matsumoto, S., Nishitani, K. and Ikeda, K. (1993) Arterial Embalming Method of the Cadaver and Its Application to Research. Kai- bogaku Zasshi, 68, 410-418.
5. Brenner, E. (2014) Human Body Preservation—Old and New Techniques. Journal of Anatomy, 224, 316-344. https://doi.org/10.1111/joa.12160
6. Mayer and Robert, G. (1990). History, Theory and Practice of Human embalming. Appleton and Lange.
7. Saeed M, Rufai AA, Elsayed SE. Mummification to plastination. Revisited. Saudi Med J 2001; 22(11): 956
8. Saeed M, Rufai AA, Elsayed SE. Mummification to plastination. Revisitedo. Saudi Med J 2001; (22): 956-959
9. Abdel-Maksouda, G. and El-Aminb, A.-R. (2011) A Review on the Materials Used during the Mummification Processes in Ancient Egypt. Mediterranean Archaeology and Archaeometry, 11, 129-150.
10. David, A.R. (1990) The History of Mummification. In: David, A.R. and Tapp, E., Eds., The Mummy's Tale, St. Martin's Press, London, 37-46.
11. Abdel-Maksouda, G. and El-Aminb, A.-R. (2011) A Review on the Materials Used during the Mummification Processes in Ancient Egypt. Mediterranean Archaeology and Archaeometry, 11, 129-140.
12. Sargon, M.F. and Tatar, İ. (2014) Plastination: Basic Principles and Methodology. International Journal of Experimental and clinical Anatomy, 8, 13-18.
13. Pashaei, S. (2010) A Brief Review on the History, Methods and Applications of Plas- tination. International Journal of Morphology, 28, 1075-1079.14. Dawson, T.P.,James, R. S. and Williams, G.T. (1990) HowDoWeTeachPathology? Silicone Plastinated Pathology Specimens and Their Teaching Potential. Journal of Pathology, 162, 265-269. https://doi.org/10.1002/path.1711620314.
15. Von Hagens G, Tiedemann K, Kriz W. The current potential of plastination. Anat Embryol (Berl) 1987; 175(4): 411-421.
16. Holladay, S. D. and Hudson, L. C. (2009). Use of plastinated brains in teaching neuroanatomy at the North Carolina State University, College of Veterinary Medicine. Journal of the International Society for Plastination, 3 (1): 15–17.
17. Bickley, Harmon, C., Robert, S., Conner, M., Anna, N., Walker and Lamar, J. R. (2009). Preservation of tissue by silicone rubber impregnation. Journal of the International Society for Plastination, 1 (1): 30–36.
18. Janick L, DeNovo RC, Henry RW. Plastinated canine gastrointestinal tracts used to facilitate teaching of endoscopic technique and anatomy. Acta Anat (Basel) 1997; 158(1): 48-53 [PMID: 9293297].
19. Al-Zuhair, A. G., Butt, M.M and Amonoo- Kuofi, H. S (1995). Plastination, a modern technique supplementing the teaching of anatomy. Biomed. Res., 6: 231-233.

20. Saeed M, Rufai AA, Elsayed SE. Mummification to plastination. Revisited. Saudi Med J 2001; 22(11): 956-959.

21. Sargon, M.F. and Tatar, İ. (2014) Plastination: Basic Principles and Methodology. International Journal of Experimental and clinical Anatomy, 8, 13-16.22. VonHagens,G.,Tiedemann,K.andKriz,W.(1987)TheC urrentPotentialofPlas- tination. Anatomy and Embryology, 175, 411-421.

23. Pashaei, S. (2010) A Brief Review on the History, Methods and Applications of Plastination. International Journal of Morphology, 28, 1075-1076.24. Shahar,T.,Pace,C.andHenry,R.W.(2007)EpoxyPlastina tionofBiologicalTissue: VisDocta EP73 Technque. Journal of the International Society for Plastination, 22, 46-49.

25. Weber, W. and Henry, R.W. (1993) Sheet Plastination of Body Slices E12 Tech- nique, Filling Method. Journal of the International Society for Plastination, 7, 16-22. 26. Shahar, T., Pace, C.and Henry, R.W. (2007) Epoxy Plastination of Biological Tissue: VisDocta EP73 Technque. Journal of the International Society for Plastination, 22, 46-49.

27. Latorre, R. and Henry, R.W. (2007) Polyester Plastination of Biological Tissue Technique for Body Slices. Journal of the International Society for Plastination, 22, 69-72.

28. Saeed M, Rufai AA, Elsayed SE. Mummification to plastination. Revisited. Saudi Med J 2001; 22(11): 956-959.

29. Janick L, DeNovo RC, Henry RW. Plastinated canine gastrointestinal tracts used to facilitate teaching of endoscopic technique and anatomy. Acta Anat (Basel) 1997; 158(1): 48-53.30. Johnson, E.C., Johnson, G.R. and Johnson, M. (2012) The Origin and History of Embalming. In: Mayer, R.G., Ed., Embalming—History, Theory, and Practice, McGraw-Hill, New York, 467-509.

31. Bradbury SA, Hoshino K. An improved version embalming procedure for long-lasting preservation of the cadaver for anatomical study. Acta Anat (Basel) 1978; 101(2): 97-103

32.. Coleman R, Kogan I. An improved low-formaldehyde embalming fluid to preserve cadavers for anatomy teaching. J Anat 1998; 192 (Pt 3): 443-446

33. Mayer RG. Embalming History, Theory and Practice. 4th Edn, McGraw Hill New York London.2006, pp: 457-498.

34. KS Narayan Reddy. The essentials of forensic medicine and toxicology . JAYPEE 2012;156-160.