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An Innovative 3d Plastination Technique, A Newer Modality To Study The Hollow Organs Or Viscera With Special Emphasis On Shape

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Abstract:
Anatomical study of hollow viscera like stomach by routine method has many limitations and hazards too. The formalin is known to cause various health hazards on long standing exposure. So to improve the students' perception regarding shape of hollow viscera, this technique is developed. This technique will definitely improve the understanding of shape of hollow viscera without exposing teachers and learners to hazard of formalin.

Key words: *Singel's 3D technique, hollow viscera, shape, stomach, silicon gun.*

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I. Introduction:

Human body consists of a number of organs. Some of these are solid while others are hollow. The shape of hollow organs varies greatly. Some are tubular (eg. intestine, ureter, etc.) while others are dilated (eg. gall bladder, stomach, etc.). During the morphological study of these hollow organs, it is observed that their shape in different cadavers varies significantly.

The traditional method adopted to study such organs is the dissection method. We dissect the human body, study the given organ at it's place (i.e. in situ), then take the concerned organ out of the body and study it. Usually the organ to be studied is empty at this point of time.

Whenever the same organ is studied in living human beings, it is never always empty. If we observe the radiological or ultrasonographic images of abdomen, the stomach is filled to varied extent. So to remove the differences of fullness and emptiness and to facilitate the study of hollow organs in a more life-like form, this study was conducted. Though the technique is useful for any hollow viscera, the stomach is considered as a prototype organ for further discussion. As repeated immersing of organ in formalin solution is not needed after this technique, definitely the formalin exposure is reduced.

II. Materials:

Materials required for this technique are:

- Hand gloves
- Silicon gun
- High grade acetic cure silicon sealant
- Dissection instruments
- String

III. Methodology:

Adopting the routine dissection protocol, the abdominal cavity is opened. The stomach is studied in situ with neighbouring organs in their respective places. Then by cutting the peritoneal reflections, stomach is taken out of the body. Pyloric end is tied with the help of string.

The interior of the stomach is cleaned by gentle running tap water. Forceful use of water may damage the mucosa of stomach. The extra redundant peritoneal reflections are trimmed off keeping the necessary extent in it's place for better cosmetic appearance. This also increases the view of important anatomical features.

Then using silicon gun, the silicon sealant is injected slowly into the stomach from cardiac end. The stomach is completely filled with high grade acetic cure silicon sealant and is put in 10 % formalin solution for the next 7 days. After 7-8 days, the sealant becomes hard and specimen is ready for further study. The specimens are stored in a very much diluted formalin solution for lifetime storage.

Observations and results:

The image seen in Fig. 1 is of a normal specimen of J-shaped stomach (pre-treatment) as it appeared after removing from the abdominal cavity.

Fig. 1: Normal J-shaped stomach (pre-treatment)

After injection with silicon sealant, the same specimen appeared in a life-like form, as is seen in Fig. 2.

Fig. 2: Normal J-shaped stomach (post-treatment)

Another specimen seen in Fig. 3 shows the morphological features of steerhorn-shaped stomach after injection.

Fig. 3: Steerhorn-shaped stomach (post-treatment)

A specimen of stomach involved in diaphragmatic hernia with absence of fundus part of stomach as is seen in Fig. 4

Fig. 4: Stomach involved in diaphragmatic hernia

A specimen showing an irregular shaped stomach (post-treatment) as is seen in Fig. 5.

Fig. 5: Irregular-shaped stomach (post-treatment)

Another post-treatment specimen showing an hour-glass type of stomach (Fig. 6).

Fig. 6: Hour-glass stomach (post-treatment)

IV. Discussion:

Study of anatomy without dissection can't be thought of. Dissection, an age-old technique of study of anatomy, helps students to build and develop professional competencies[1]. But at the same time, health hazards of formalin cannot be neglected. So use of formalin should be minimized for safety of students and medical college faculty.[2]

In addition to traditional teaching methods like chalk board teaching and dissection, newer methods like power-point presentations and ultrasonography should also be incorporated in anatomy teaching. 3-D learning has definitely more impact on students' learning ability.[3]

Computer-assisted learning, simulation-based training, use of true-to-plastic models, plastination, etc. are some of the newer technologies used in anatomy teaching.[4] Cognitive behavioural training methods with students' active participation leads to critical, reflective and qualified medical professionals.[5] Clinical-oriented study of anatomy is the need of the hour. Such anatomical study will form strong basis for future clinical developments.[6]

So with more emphasis on clinical aspect with less exposure to hazardous formalin, a number of latest techniques are described in scientific literature and are currently used in various parts of the world. Well-known technique like plastination and comparatively cheaper, durable technique like Enaldy technique are few of them.[7] Air drying of specimen with help of compressor pump and subsequently filling it up with foam has also been described as one way of preservation of hollow viscera.[8]

So, our primary aim was to find a preservation technique for anatomical viscera which would minimize use of formalin and it's derivatives with enabling student to learn about the viscera in it's life-like form creating awareness and interest of clinical anatomy in students' mind. After an exhaustive trial with different chemical agents, we found silicon sealants to be suitable for this purpose. More electronegativity of silicon leading to stronger Si-O bond makes it more stable. Chemical resistance, weathering and high temperature resistance are amongst few properties which make it still better.[9]

V. Conclusion:

Study of the morphology of anatomical specimens showing both the normal features as well as rare morphological anomalies form an integral part of the curriculum. Visualizing these organs and viscera in a life-like form is a major boost to better understanding of the subject matter by the students. The use of silicon sealant for preparing such life-like appearing specimens not only reduces the risk of exposure to the hazardous formalin but also ensures better understanding of the subject matter. Thus we conclude that the use of our 3D technique will serve as a newer modality to facilitate the study the hollow anatomical viscera with special emphasis on their shape.

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