

IMPROVED TECHNIQUES IN PRESERVING CATS FOR ANATOMICAL STUDY

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ABSTRACT

Salt-formalin and salt-formalin-alcohol I solutions have been found to be effective in preventing the growth of molds on embalmed specimens, and free it from attack by worms, and from putrefaction and desiccation. The specimens embalmed in these solutions are whitish with normal body form and do not have shrunken, coarse muscle textures, but rather clear muscle outlines appropriate for dissection and study. These specimens were subjected to longer initial immersions of 6 to 8 days and had a 100 percent survivance period of more than 89 days. The specimens were 100 percent free from molds or worms, and putrefaction and desiccation did not set in from the start of the study until its completion.

Introduction

Cat specimens used for the study of anatomy are preserved in 5% formalin. This solution is introduced into the body cavity through a slit by injecting into the femoral artery/sciatic vein. To insure the preservation of the viscera, the specimens are then immersed in this solution for three days. Other preserving methods are those of Hyman (1965) which used an embalming fluid consisting of formalin, carbolic acid, glycerin and water, in which the fluid is injected into the femoral artery or sciatic vein using a cannula. Walker (1972) immersed his specimen in a solution of alcohol and formalin, glycerin and melted crystal of carbolic acid. This researcher, on the other hand, injected the cats with 4% or 5% formalin followed by the immersion of the skinned cats in the salt-formalin solution prepared by mixing 4% formalin and 20% salt solution with a ratio of 3:7 for 3 days.

This study aims to develop techniques in embalming cats which would make them last for 5 months* or more without having to repeatedly soak the specimens in the salt-formalin solution. It also intends to increase the effectiveness of the preservative through the addition of reasonably-priced and available additives, and also to test the effectiveness of other preserving solutions.

This study will improve the quality of the cat specimens by eliminating the problem of worms and molds infestation, fast desiccation and decomposition, and the strong odor of formalin.

MATERIALS AND METHODS

Materials.

Cats: Medium and large size

Soaking cans: 4" x 15" x 35" or any cans of appropriate size

Injecting materials:

- Dextrose bottles
- Syringe needles
- Cannula (plastic tube)

Wrapping materials:

- Plastic bags
- Empty flour bags

Scraping and rubbing materials:

- Scalpel
- Coarse brush (1 inch)
- Absorbent cotton

Injecting and immersing solutions:

- 5% formalin
- 165 ml of 37% formalin plus 835 ml water

Salt-formalin

- 30 parts of 4% formalin to 70 parts of 20% salt solution

Salt-formalin-lysol

- 5 cc lysol in 20 liters of salt-formalin lin

Salt-formalin-alcohol 1

- 5 parts of denatured alcohol 95 parts of salt-formalin

Salt-formalin-alcohol-lysol

- 2.5 parts of denatured alcohol to 97.5 parts of salt-formalin. To 20 liters of this solution is added 5 cc of lysol.

20% salt

- 200 grams of crystal salt plus 800 ml of water

Formalin-alcohol-glycerin

- 10 parts of glycerin to 50 parts of 4% formalin to 40 parts of 95% ethyl alcohol.

Formalin-boric acid glycerin

- 1 part of glycerin to 60 parts of 10% boric acid solution to 39 parts of 4% formalin

Salt formalin-glycerin

- 2 parts of glycerin to 98 parts of salt-formalin

Procedure.

Sample specimens were prepared and coded as shown in Table 1.

Table 1. Sample Preparation

Specimen code	Sample Preparation
A. Immersion for 3 days	
1	Injected and immersed in 5% formalin solution
2	Injected with 5% formal solution and immersed in salt-formalin solution
3	Injected with 5% formalin and immersed in salt-formalin-lysol solution
4	Injected with 5% formalin solution and immersed in salt-formalin-alcohol 1 solution
5	Injected with 5% formalin solution and immersed in salt-formalin-alcohol-lysol solution
6	Injected with 5% formalin solution and immersed in 20% solution
7	Injected with 5% formalin solution and immersed in salt-formalin for 2 days, then lysol solution for 1 day
8	Injected with salt-formalin-glycerin solution and immersed in salt-formalin solution
9	Injected with formalin-alcohol-glycerin solution and immersed in salt-formalin alcohol II solution
10	Injected with boric acid-formalin-glycerin solution but not immersed
B. Immersion for 4 days	
11	Injected with 5% formalin solution and immersed in salt-formalin solution I
12	Injected with 5% formalin solution and immersed in salt solution formalin-alcohol I solution
C. Immersion for 6 days	
13	Injected with 5% formalin solution and immersed in salt-formalin solution

- 14 Injected with 5% formalin solution and immersed in salt-formalin-alcohol I solution immersed in salt-formalin-alcohol 1 solution
- D. Immersion for 3 days
- 15 Injected with 5% formalin solution and immersed in salt-formalin solution
- 16 Injected with 5% formalin solution and immersed in salt-formalin-alcohol I.

The embalmed cats were observed for any sign of growth of molds, worm infestation, putrefaction and dryness and odor.

During the study the cat specimens which were slightly or moderately infested by molds and worms, and those slightly decomposed were injected or moistened with their injecting fluids or both; those specimens which were heavily attacked by molds or worms were re-immersed in their immersing fluids. However, prior to being immersed, these were first scraped clean of molds or worms (Figure 2).

RESULTS AND DISCUSSION

More than forty cats were used in the study in the preliminary testing of the various fluids. The preserving fluids found effective in warding off fungal and worm infestation, delaying putrefaction, and imparting flesh and body characteristics of good specimens for dissection and study, were used in the final experiments. In the final study, 45 cats and 13 preserving fluids were used. A set consisted of 2 to 3 cat specimens.

Body characteristics

General Body Appearance.

Generally, the cat specimens embalmed in the different preserving solutions retained their normal body form, and they were all whitish (Fig. 1), except for the cat specimens which were immersed in salt-formalin solution for 2 days and in lysol for 1 day which shrunk and turned slightly dark.

Muscle Texture

About 94% of the cat specimens have shown a coarse muscle texture, distinct and clear muscle outlines and fibers (Fig. 1, 4, 5). These characteristics, it was noted, are lost when the specimens are infested by molds (Fig. 3) and worms or become putrefied.

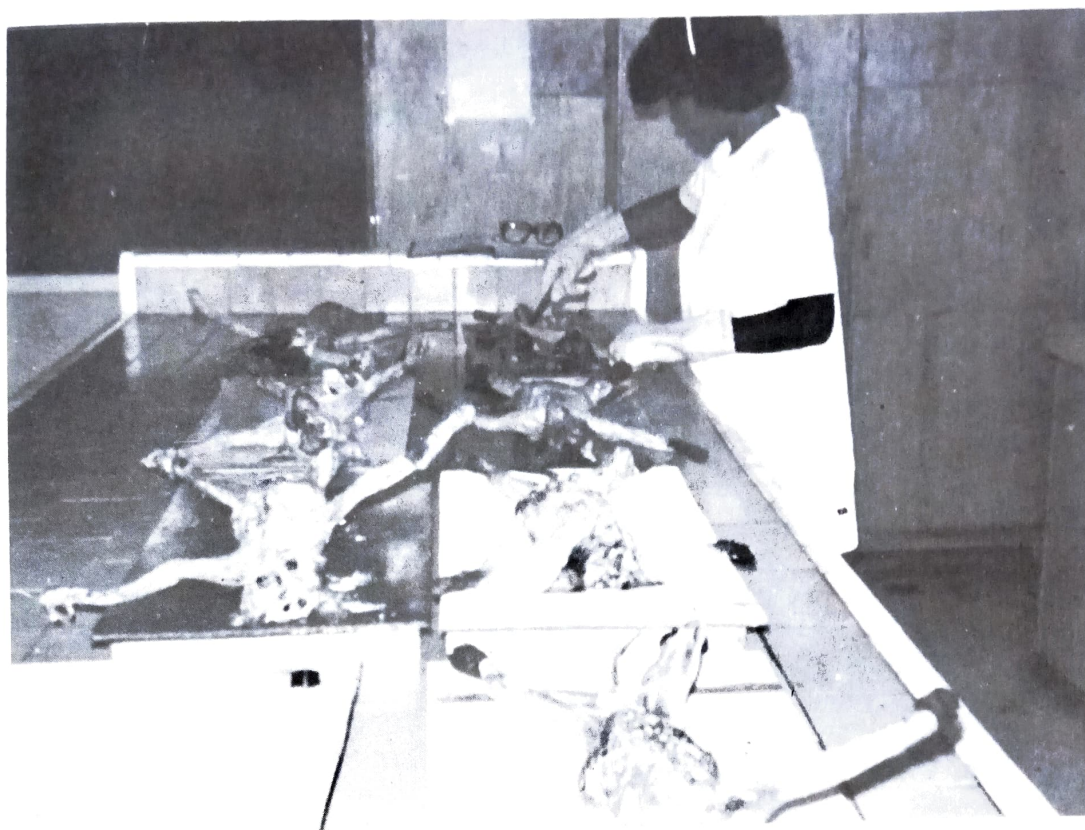


Figure 2. Cleaning the specimens of molds before treatment is applied.



Figure 3. Cat specimen spoiled by thick molds.



Figure 4. Eighty-day old specimens.



Figure 5. Ninety-day old specimens.

Intensity of Odor/Smell.

The cat specimens preserved in 5% formalin solution emitted a strong and irritating odor of formalin. The rest of the specimens, on the other hand, had the mild odor of the other components of the preserving solutions.

The specimens whose body flesh underwent some degree of decomposition or deterioration emitted rotten or very foul smells.

Mold and Worm Infestation

Mold Infestation.

Occurrences of fungal colonies (molds) on the cat specimens varied, hence treatments applied depended on the degree of infestation. For slight fungal infestation, the specimens were either injected with the preserving fluid or the affected areas were moistened with the solution. In cases of moderate to heavy infestation, the specimens were reimmersed in the solution.

As shown in Table 2, sample specimens prepared by injecting it with 5% formalin solution and immersed for 3 days in a) salt-formalin, b) salt-formalin-lysol, c) salt-formalin-alcohol 1 solutions, needed 4-5 treatments to prevent or minimize mold infestation. The samples that were prepared in the same manner but immersed for 4 days, 6 days, and 8 days and regularly wet with their immersing solutions needed no further treatment after the initial preparation.

Samples prepared by injecting it with the 5% formalin but immersed for 3 days in the following solutions a) salt-formalin lysol, b) 20% salt, and c) salt-formalin for 2 days, then lysol for 1 day, which needed 5-6 treatments were discarded before the end of the study due to molds and dryness. Likewise, those injected with the following solutions a) salt-formalin-glycerin, b) formalin-alcohol-glycerin, and immersed for 3 days in solutions a) salt-formalin and b) salt-formalin II, needed 5-6 treatments and were discarded in less than 50 days because of molds and dryness. Similarly, the samples injected with boric acid-formalin-glycerin without immersion were discarded after 20 days due to dryness after being subjected to 5 treatments to prevent mold infestation.

The samples injected and immersed in 5% formalin solution needed 6 treatments, and the specimens were discarded in less than 50 days because they became dry and stone-hard.

Worm Infestation.

In the course of the study, worm infestation posed no serious problem to the sample specimens. Like the molds, worm infestation on the specimens was limited and localized. The frequently infested areas of the specimens were the mouth, neck, and limb extremities. Occasionally, the viscera and the base of the limbs were also attacked, especially when they became soft and tender or slightly decomposed. These attacked body parts were, in most cases, not fully saturated with the pre-

serving solutions. Any other parts of the body, when not completely penetrated by the solutions, became susceptible to attack by either molds or worms.

When specimens were slightly or moderately infested by worms, they were injected with either the injecting or the immersing solution. Injecting with the preservative was preferred over wetting because the fluid or solution penetrated deeper into the affected portions of the body. Immersion was resorted to only when the specimens were badly attacked by worms.

As shown in Table 2, all the sample specimens from 1-10 received 1-3 treatments for worm attack less than those for mold growth. The sample specimens from 11-16 needed no further treatment after the initial treatment or preparation.

Based on these results the sample preparations were said to be effective in preventing or curtailing attack by worms and the data on Table 2 show that no specimen was discarded because of damage caused by worms.

Specimen (Set)	Number of Treatments			Resistance as to number of days	Reason for discarding specimen
	Molds	for Worms	Putrefaction		
1	6	3	2	48	Dryness
2	4	1	1	102	Termination of study
3	4	1	1	95	--do--
4	3	1	1	103	--do--
5	6	1	1	50	Molds
6	5	2	2	32	Molds and dryness
7	5	2	2	34	--do--
8	6	2	2	47	Molds
9	5	1	1	20	Molds and dryness
10	5	1	2	20	Dryness
11	3	0	0	90	Termination of study
12	0	0	0	90	--do--
13	0	0	0	90	--do--
14	0	0	0	90	--do--
15	0	0	0	92	--do--
16	0	0	0	92	--do--

Putrefaction and Desiccation

Putrefaction.

The preservatives and the techniques used in preventing decomposition of the specimens were similar to those applied to ward off worm attack. The occurrence of putrefaction was also limited and localized. Where worms thrived, the flesh portions would most likely be deteriorated. The putrefied portions emitted a foul odor.

Treatment of rotten or decomposed portions of specimens was done by injecting it with their or immersing solution. There were occasions when the specimens were subjected to one or two re-immersions. However, these re-immersions were intended not as treatment for decomposition but for killing the molds and worms.

Table 2 shows that cat specimens 1-10 received 1-2 treatments, and that specimens 11-16 received no treatment at all after the initial preparation. No specimen was discarded because of decomposition.

The few treatments that the sample specimens were subjected to showed that the sample preparations or treatments and the techniques applied in maintaining the specimens to inhibit or arrest further decomposition were quite effective.

Desiccation.

As noted, desiccation or dryness was rather fast on some specimens and slow on others. The specimens which were injected with and immersed in 5% formalin had a slower rate of dryness; however, they were discarded before the 50th day because most of the parts of the specimens' bodies ultimately became hard.

The specimens injected with boric acid-formalin-glycerin but not immersed desiccated so rapidly that on the 20th day they were all discarded. The specimens which were injected with formalin-alcohol-glycerin and immersed in salt-formalin-alcohol II, and the specimens immersed in salt-formalin for 2 days and in lysol for 1 day, and those immersed in 20% salt solution showed slower desiccation, but they were all discarded in less than 35 days because of heavy molds and dryness (Fig. 2). In these specimens, the head, thorax, and the viscera had high levels of mold infestations.

The techniques of longer immersion wrapping of the specimens with moist cloths had contributed greatly in the maintenance of the softness and pliability of the body flesh, as in specimens 11-16.

Preservation of Specimens

To a great extent, the continued preservation of the specimens as indicated by the absence of molds, worms, putrefaction and desiccation depended on the kind of the preservative and techniques used. For molds infestation, the preservative solu-

tions and techniques used could either inhibit or promote the growth of molds. For instance, of the specimens from 1-10, only those immersed for 3 days in a) salt-formalin, b) salt-formalin-lysol, and c) salt-formalin-alcohol. I had lasted for more than 95 days, while the rest had a preservation period of less than 48 days. And specimens 11-16 which were immersed for 4, 6 and 8 days had survived until the study was completed without any single treatment following the initial preparation (Table 2).

Effects of Additives

Several additives were used purposely to increase the potency and effectiveness of the embalmed cats against molds, worms, putrefaction and desiccation. Such additives were alcohol, lysol, and glycerin. Alcohol and lysol were found to slightly increase the potency of the preserving salt-formalin solution. Moreover, alcohol produced an aromatic odor on the specimens, whereas lysol caused a nauseating odor. Glycerin was found to have no significant augmenting effect on the salt-formalin solution.

Generally, the salt-formalin-alcohol solution produced similar body characteristics as the salt-formalin solution, except that in the former solution the specimens were more whitish than the cats preserved in the latter solution.

SUMMARY AND CONCLUSION

Five injecting solutions and eleven immersing solutions were tested for their potency and effectiveness to inhibit and ward off molds and worms, delay putrefaction, and slow down desiccation of the embalmed cats.

The injecting solutions of 5% formalin coupled with the immersing solution of salt-formalin or salt-formalin-alcohol I were found to cause 100 percent of the specimens to last for more than 89 days. The rest of the injecting and immersing solutions were less effective and potent, and gave a resistance period of less than 55 days.

The technique found to be effective was by first injecting the cat with 5% formalin, and then to soak it in the immersing solution for a period of 6 to 8 days.

After dissection, the specimen was moistened or wet, and then wrapped with moist cloth.

The additive denatured alcohol in the salt-formalin solution, i.e., salt-formalin-alcohol I, was noted to slightly increase the potency of the salt-formalin.

The specimens preserved in salt-formalin and salt-formalin-alcohol I show the following:

1. The general body appearance of the specimens is whitish; the muscle texture is coarse; the muscle outlines and fibers are clear and distinct; and the body form is normal, not shrunken.

2. The odor of the specimens is mild and endurable for one's eyes and nose.
3. The growth of molds and worms and putrefaction is 100% inhibited.
4. Desiccation or dryness of the specimens is generally slow.

It was further established that the length of time the specimens stayed in the immersing solutions in the initial preparation (that is, between 6 and 8 days) and the regular wetting of the specimens prolonged the preservation to more than 89 days without any sign of molds and worms; also there was no putrefaction or dryness from the start of the study until its completion.

RECOMMENDATION

The following preservatives and procedures are recommended in embalming and preserving / maintaining the cat specimens:

Preserving fluids: Use a 5% formalin (based on 37%) as an injecting fluid and either the salt-formalin or salt-formalin-alcohol I solution as immersing fluid.

Embalming procedure. Inject the cat with 1 liter of 5% formalin by gravitational flow. Any extra fluid is injected to the portions of the specimens which have not been well-saturated with the fluid.

Maintaining the specimen. To maintain the cat specimen's softness, pliability and good texture, and to free it from molds and worms, wrap it with a moist cloth. After dissecting the cat, it is advisable to wet the body before wrapping it.

It is further recommended that this study be pursued to experiment with the same preservatives and techniques on human cadavers.

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