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Original Article

Can homemade alcohol (*raksi*) be useful for preserving dead bodies? An experiment on wistar albino rats

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Abstract
Introduction: Embalming is the through disinfection and art of preserving bodies after death using chemical substances. It keeps a body life like in appearance during the time it lies in a state prior to funeral.
Objective: This study was undertaken to investigate the effectiveness of *Raksi* in sacrificed rats in arresting postmortem changes and establishing scientific fact whether *Raksi* can be an alternative to standard embalming constituent if it is not available.
Material and methods: 50 albino rats were systematically randomized into control and experiment groups. *Raksi* and distilled water were injected for embalming purpose intraventricularly in experiment and control groups of rats respectively and kept for 48 to 96 hours for observation for postmortem changes.
Result: Observations made at 48 and 72 hours of embalming revealed that *Raksi* can arrest postmortem changes in the rats up to 72 hours (3rd day) successfully in the experimental group whereas moderate to severe postmortem changes were seen in the control group. The experimental group showed mild degree of putrefactive changes, liberation of gases and liquefaction of tissues only at 96 hours (4th day) of embalming.
Discussion: The Raksi used in this experiment contained 34% of alcohol, which was determined by an alcohol hydrometer. Experiment clearly demonstrated from its result that raksi can be utilised temporarily for embalming since it contains alcohol and has preservative, bactericidal and disinfectant properties.
Conclusion: It is concluded from the study that this knowledge if applied to dead human subjects, may preserve dead bodies temporarily allowing delayed funeral.

Key words: Rat, Embalming, Homemade alcohol, Raksi, Funeral

Embalming is the thorough disinfection and art of preserving bodies after death using chemical substances (formalin, carbolic acid, alcohol, cedar wood oil etc). It keeps a body life like in appearance during the time it lies in a state prior to funeral (funeral embalming) or scientific studies at leisure including dissection as a part of teaching learning purpose (anatomical embalming). [1]

In villages of Terai (plane), hilly region, and remote areas of Nepal standard embalming chemical substances are not available but homemade alcohol (*Raksi*) is easily available in any part of the country. Hence with pre-existing knowledge of properties of alcohol as a preservative, bactericidal and disinfectant, *Raksi* has been chosen to preserve sacrificed rats temporarily as it contains ethyl alcohol.

Alcohols are organic compounds that are obtained by various methods. Fermentation of sugars (molasses from sugarcane or starch obtained from various grains and vegetables) by yeast leads to production of ethanol (ethyl alcohol) and certain other alcohols. Ethanol is the oldest synthetic organic chemical used by men for various industrial purposes. It is easily soluble in water. It has a boiling point equal to 78.3^{o} C and relative density 0.789 at 20^{o} C. Ethanol is the alcohol of 'alcoholic' beverages. Ethyl alcohol is also used for pleasure and has psychological effects. It is capable of producing dependence. Medically ethanol is classified as hypnotic agent whereas other alcohol, for example, methanol is quite poisonous. [2]

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Ethyl alcohol has been used as a preservative for specimens in fluid for centuries. The alcohol slows the rate of decay of biological material by killing bacteria[3,4]. The present study was undertaken to investigate the effectiveness (success) of *Raksi* in sacrificed rats in arresting postmortem changes and establishing scientific fact whether *Raksi* can be an alternative to standard embalming constituent if it is not available. If the fact is established, it could be used in delaying funeral.

Material and methods

Fifty adult albino rats weighing 200 to 250 gm, consisting of males and females were procured in the animal house of Department of Anatomy and randomly divided into control and experiment groups containing 20 in control and 30 in experimental. Research Grant of BP Koirala Institute of Health Sciences, Dharan, funded this project; and Ethical Research Board of the institute granted ethical clearance to carry out the study.

Raksi was purchased from reliable local source. Selection of *Raksi* was confirmed on the basis of combustibility (ethyl alcohol burns in air with blue flame), which when subjected to fire produce flame.

Before embalming rats were anaesthetized by intraperitoneal Ketamine in a dose of 8 mg /100 g [5] (available preparation 20 mg/ml) and kept in an airtight container for 10 min which ensured that the rats were no more alive. After 4 hours of killing the experimental rats were injected Raksi intraventricularly with a dose of 25 ml / 100 g and control group received distilled water in a similar dose and methods.

Embalming was considered successful when the tails became straight and oozing of fluids started through nostrils and oral cavity. Thereafter both groups of rats were wrapped in a polythene bag to prevent vaporization of moisture and kept for 48 to 96 hours (2-4 days) in a temperature ranging from 28-34 ^{o}C.

On the 2nd and 3rd days, 10 rats from each group were examined to observe postmortem changes, viz., putrefaction and liberation of gases. Similarly, remaining 10 rats from experimental group were examined for postmortem changes on the 4th day. Further, rats from both groups were dissected to observe liquefaction of tissues.

Results were documented from direct observation of postmortem changes (qualitative or subjective). The subjective positive findings were recorded in terms of mild, moderate and severe and categorized as (+), (++) and (+++) respectively. Negative finding was denoted as (-) as shown in Table 1. To avoid bias, the observations were done independently by principal investigator and co-investigators. There was good agreement among the observers according to kappa statistics.

Results

Observation made on 10 rats from control group at 48 hours in term of putrefaction, liberation of gas and liquefaction of tissue were found moderate (++) where as at 72 hours in the same number of rats the qualitative subjective changes were found (+++) severe (Tables 2 and 3). Observation made in experimental group of rats at 48 and 72 hours (ten rats / session of observation) showed no (-) postmortem changes (Tables 2 and 3). At 96 hours (4th day) remaining 10 rats from experimental group were observed and only mild postmortem changes (+) were recorded in them (Table 4).

Table 1: Grading of Postmortem Changes

Putrefaction		Liberation of gases		Liquefaction of tissue involving organ system	
Features	Grade	Features	Grade	Organ-system	Grade
1-2 bluish patches on ventral aspect of abdominal wall	-	No foul smelling	-	No involve of any organ systems	-
Multiple (>2) bluish patches on ventral aspect of abdominal wall	+	Trace of foul smelling	+	Brain and thoraco-abdominal organs only	+
All the above features plus generalized dark bluish discoloration of the body	++	Tolerable foul smelling	++	All the above organs plus skeletal muscles	++
Rotten	+++	Intolerable foul smelling	+++	All the above organ plus skins and tail	+++

Table 2: Postmortem changes in control and experiment groups of rats at 48 hours of experiment

S. No.	Parameters	Observation	
		Control Group (n=10)	Experiment Group (n=10)
1.	Putrefaction	++	-
2.	Liberation of gas (foul smelling)	++	-
3.	Liquefaction of tissue	++	-

Table 3: Postmortem changes in control and experiment groups of rat at 72 hours of experiment

S. No.	Parameters	Observation	
		Control Group (n=10)	Experiment Group (n=10)
1.	Putrefaction	+++	-
2.	Liberation of gas (foul smelling)	+++	-
3.	Liquefaction of tissue	+++	-

Table 4: Postmortem changes in experimental groups of rats at 96 hours of experiment

S. No.	Parameters	Observation (n=10)
1.	Putrefaction	+
2.	Liberation of gas (foul smelling)	+
3.	Liquefaction of tissue	+

Discussion

Since this study is based on ancient ideas of embalming, available literature (electronic and other) has hardly any report on use of homemade alcohol for preserving the body. Only literature related to historical embalming as application of honey, aloes, spices, navy rum, brandy and wax was available. [6,7]

One unusual embalming process practiced in late 1800s was preserving dead person in alcohol[8]. Another instance of preservation by immersion in alcohol was casking of remains of Lord Nelson in ship's brandy store during Battle of Trafalgar in 1805. This also proves alcohol's preservative effect[9]. Egyptians had custom of immersing dead body in carbonate of soda after injecting balsam through blood vessels and filling the cavity with aromatic substances and salts. [10] In our study rats were preserved temporarily for 3 days (72 hours) without any postmortem changes but on 4th day (96 hours) we found mild postmortem changes.

Our experiment clearly demonstrates that Raksi can be utilised for temporary embalming since it contains alcohol and has preservative, bactericidal and disinfectant properties. [3, 4] The Raksi used in this experiment contained 34% of alcohol, which was determined by an alcohol hydrometer. Although, available media searched did not yield similar reports in human dead subjects till date, good results are expected while preserving dead bodies temporarily as observed in our study. To be on safer side, before application of this knowledge to delay funeral and postmortem changes, a further study is required to confirm the findings in human dead bodies. We are planning to extend this study on human cadavers.

In remote and hilly areas where neither doctor nor formalin is available, alcohol can be used as an alternative method for preserving the dead body temporarily. In remote set up and even in most district head quarter of Nepal alcohol hydrometer may not be available. Therefore criteria of choosing the quality of Raksi to be selected for embalming have to be predetermined as which could produce flame when subjected to fire.

Conclusion

Use of homemade alcohol i.e. Raksi on animal model has temporarily preserved the killed rat arresting postmortem changes. Study period ended at 96 hours after embalming. Till 72 hours (3rd day) experimental group of rats were preserved without any foul smelling (liberation of gases), putrefaction and liquefaction of tissue but at 96 hours it showed mild (+) signs of postmortem changes. Hence use of this knowledge in human dead subjects wherever

formalin or other preservative agents are not available Raksi may be used with positive outcome, preserving the dead body and preventing further decay. Prevention of decay ultimately allows delayed funeral, whenever near and dear has to come from long distance or from abroad.

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