

Evaluating the Embalming Procedures of Putrefying Bodies in Relation to Gender in Anambra State, Nigeria

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Introduction:

Embalming is the art and science of preserving a dead body so as to achieve an aseptic condition, a pre-mortem appearance and preservation of the body for a long period of time (Biswas, 2012). Putrefaction is the fifth stage of death, following pallor mortis, algor mortis, rigor mortis, and livor mortis (Rao, 2013). In addition, putrefaction is the process of breakdown of the human body after death. In broad terms, putrefaction can be viewed as the decomposition of proteins, and the eventual breakdown of the cohesiveness between tissues, and the liquefaction of most organs. This is caused by the decomposition of organic matter by bacterial or fungal digestion, which causes the release of gases that infiltrate the body's tissues, and leads to the deterioration of the tissues and organs (Clark *et al*, 1997). Several stages have been proposed for the decomposition process (Goff, 2009). Five stages have been recognized and these appear to be easily applied to studies conducted in temperate areas (Clarence and Fredrick, 1989; Lord and Goff, 2003; McLemore and Zumwalt, 2003). These stages are: Fresh, Bloated, Decay, Post-decay and Skeletal or Remains. The most common modification of this set is to subdivide the Decay Stage into Active Decay and Advanced Decay stages (Goff, 2009). The final stage of embalment requires preparing a body for public display at a funeral, or for religious reasons, or for medical or scientific purposes which involves the following: Body Sanitization – To destroy microbial activities leading to putrefaction; Body Preparation – The embalming process; Body Preservation – The proper storage and management of body in the mortuary; and Body Presentation – The Funeral

service preparation (Bark, 1992). There are four processes involved in embalming, thus: arterial, hypodermic, surface and cavity embalming (Jayovelu, 1991). Arterial embalming involves the injection of embalming chemicals into the blood vessels, usually via the common carotid artery. Blood and interstitial fluids are displaced by this solution. Hypodermic embalming is a supplemental method which refers to the injection of embalming chemicals into tissue with a hypodermic needle and syringe, generally used as needed on a case by case basis to treat areas where arterial fluid has not been successfully distributed. Surface embalming is another supplemental method which is used to preserve and restore areas directly on the skin's surface and other superficial areas as well as areas of damage. Cavity embalming refers to the replacement of internal fluids inside body cavities with embalming chemicals via the use of an aspirator and trocar. In recent times, arterial embalming (modern embalming) is the commonest technique used to embalm bodies in most funeral homes (mortuaries) all over the world (Jayovelu, 1991). The five stages involved in embalming dead bodies include: the embalming fluid preparation, the embalming process, temporary storage (body management phase), permanent storage and body presentation or cosmetic application stage (Rao, 2013). An ideal embalming fluid shall constitute a dilute solution of Formalin (40%), glycerine and water. The embalming process requires proper venous drainage so as to ensure a good outcome after embalment. The body should be placed on a temporary storage slab where it is monitored to abate further autolysis activity. The body is finally preserved in a permanent storage location where it is allowed to dry. The cosmetic application involves

proper preparation of the corpse for funeral purpose. A lot of scientists have developed different chemicals for the preservation of the dead and have improved on the different approaches used to preserve human remains. The practice of embalming putrefying bodies involves the restoration of body features damaged by diseases and / or accidents of different forms; and it is commonly called restorative art or demi-surgery, which should be performed by qualified embalmers with training or certain degrees such as Anatomy, Embalming Science or Thanatology (Biswas, 2012). Although records from Anatomists or other scholars tend to ignore embalming of putrefying bodies, there is need for further studies on embalming of putrefying bodies. So many authors have highlighted the need for special attention / approach on the embalmment of putrefying bodies (Lord and Goff, 2003; Rao, 2013; Brenner, 2014; Onyejike *et al.*, 2017). A survey on embalming of putrefying bodies in Anambra state show that cases of putrefying bodies resulting from accidents, electrocution, certain disease conditions, chemicals/poisons, autopsy, fire burn and drowning, require special attention. This survey also noted that age is a contributory factor to the outcome of preserving putrefying bodies (Onyejike *et al.*, 2017). In addition, some authors have noted that females decompose faster than males (Clark *et al.*, 1997; McLemore and Zumwalt, 2003; and Goff, 2009). This assertion will be highlighted in this paper so as to bring to limelight whether gender will affect the outcome of embalming putrefying bodies. Hence, this study aims to investigate the embalming procedures of putrefying bodies in Anambra state in relation to gender differences so as to draw models that will be used to improve the embalming practices on putrefying bodies. It will also bring to limelight the materials, methods and procedures employed in embalming putrefying bodies in Anambra state, Nigeria.

Materials and Methods:

The study area for this research covered six mortuaries (funeral homes) in the three senatorial zones of Anambra state, namely: Hosanna Hospital Modern Embalmment Centre, Ekwulumili, Nnewi South L.G.A., Anambra South Senatorial zone; Nnewi Diocesan Hospital Modern Embalmment Centre, Akwudo-Nnewi, Nnewi North L.G.A., Anambra South Senatorial zone; General Hospital Modern Embalmment Centre, Enugwu-Ukwu, Njikoka L.G.A., Anambra Central Senatorial zone; Chukwuemeka Odumegwu Ojukwu University Teaching Hospital Mortuary, Amaku-Awka, Awka

South L.G.A., Anambra Central Senatorial zone; Hens Funeral Home, Aguleri, Anambra East L.G.A., Anambra North Senatorial zone; and General Hospital Mortuary, Umueri, Anambra East L.G.A., Anambra North Senatorial zone. The sample size for this study is 351. This sample size was determined using a convenience purposive sampling method due to the unavailability of putrefying bodies at the study areas. This is a prospective cross-sectional study. The data were collected in two phases – during and after the embalming process using a checklist and with questionnaires obtained from the respective mortuaries for the study. The questionnaires were filled by the chief morticians and information about the gender and cause of death of each putrefying body were retrieved. There was a routine weekly observation of the embalming procedures and outcomes of embalmment on the putrefying bodies at the study areas. In addition, to ensure efficiency of data collection, the chief morticians of the study areas notified the authors whenever a putrefying body was brought for embalmment.

The following data were collected and analyzed:

1. Number of putrefying bodies compared to total number of bodies received (embalmed) in the mortuaries.
2. The embalming fluid composition for putrefying bodies used at the various study centres are as follows:

Hosanna Hospital Mortuary, Ekwulumili – 20% conc. Formalin solution (40 litres) + Water (80 litres) + Arterial Dye (150g) + Glycerine (5 litres) + Ammonium salt (150g) + 50% conc. Methanol (10 litres) + 10g of Thymol (used only during rainy season). This composition was used to embalm both normal bodies and putrefying bodies. What varied was the volume used – about 5 – 7 litres of embalming fluid (in relation to variations in body mass) was used to embalm normal bodies while 8 – 15 litres were used for bodies undergoing putrefaction. However, it was identified from the questionnaire that a different composition was used whenever cases of drowned bodies were received at this mortuary. The difference is that water will not be added to the composition of the embalming fluid. But during the period of this study, there was no case of drowned body received at this study area.

Nnewi Diocesan Hospital Mortuary, Nnewi – 20% conc. Formalin solution (40 litres) + Water (80 litres) + Arterial Dye (150g) + Glycerine (5 litres) + 50% conc. Methanol (5 litres) + 10g of Thymol (used only during rainy season). This composition

was used to embalm both normal bodies and putrefying bodies. What varied was the volume used – about 5 – 7 litres of embalming fluid (in relation to variations in body mass) was used to embalm normal bodies while 8 – 15 litres were used for bodies undergoing putrefaction. However, it was identified from the questionnaire that a different composition was used whenever cases of drowned bodies were received at this mortuary. This mortuary also adopted the mixture of which was devoid of water for embalming drowned bodies. But within the period of this study, there was no case of any drowned body received at this mortuary.

General Hospital Mortuary, Enugwu-Ukwu adopted a mixture of 20% conc. Formalin solution (40 litres) + Water (80 litres) + Arterial Dye (150g) + Glycerine (5 litres) + 50% conc. Methanol (5 litres). This composition was used to embalm both normal bodies and putrefying bodies. What varied was the volume used – about 5 – 7 litres of embalming fluid (in relation to variations in body mass) was used to embalm normal bodies while 8 – 15 litres were used for bodies undergoing putrefaction.

Chukwuemeka Odumegwu Ojukwu University Teaching Hospital Mortuary, Amaku-Awka adopted a mixture of 40% conc. Formalin solution (40 litres) + Water (120 litres) + Ammonium salt (20g). This composition was used to embalm both normal bodies and putrefying bodies. What varied was the volume used – about 7 – 10 litres of embalming fluid (in relation to variations in body mass) was used to embalm normal bodies while 7 –

Results:

Statistical Analysis for All the Mortuaries for the Study

Table 1: Table showing the number of putrefying bodies (PB) and total bodies brought for embalming in the various mortuaries used for study in Anambra state

MORTUARIES IN ANAMBRA STATE	TBR	%	PB	%
Nnewi Diocesan Hospital Modern Embalment Centre, Akwudo-Nnewi	993	39.36	158	45.01
Hosanna Hospital Modern Embalment Centre, Ekwulumili	106	4.20	14	3.99
General Hospital Modern Embalment Centre, Enugwu-Ukwu	532	21.09	23	6.55
Chukwuemeka Odumegwu Ojukwu University Teaching Hospital Mortuary, Amaku-Awka	698	27.67	89	25.35
Hens Funeral Home, Aguleri	158	6.26	59	16.81
General Hospital Mortuary, Umueri	36	1.42	8	2.27
TOTAL	2523	100	351	100

From the table above, the highest percentage of putrefying bodies from total bodies brought for embalming was observed in Nnewi Diocesan Hospital Modern Embalment Centre.

Key:

TBR – Total Body Received

PB – Putrefying Bodies

15 litres were used for bodies undergoing putrefaction.

Hens Funeral Home, Aguleri adopted a mixture of 40% conc. Formalin solution (40 litres) + Water (120 litres). This composition was used to embalm both normal bodies and putrefying bodies. What varied was the volume used – about 5 – 7 litres of embalming fluid (in relation to variations in body mass) was used to embalm normal bodies while 8 – 15 litres were used for bodies undergoing putrefaction.

General Hospital, Umueri adopted a mixture of 20% conc. Formalin solution (40 litres) + Water (120 litres) + Glycerine (5 litres) + Ammonium salt (150g). This composition was used to embalm both normal bodies and putrefying bodies. What varied was the volume used – about 7 – 10 litres of embalming fluid (in relation to variations in body mass) was used to embalm normal bodies while 8 – 15 litres were used for bodies undergoing putrefaction.

1. Bio data of the bodies – Gender in relation to embalming practices and its outcome.

Other data that were obtained include: embalming techniques, management procedures and storage procedures. The data were inferentially analysed using Statistical Package for Social Science (SPSS) version 20.0.0. The data were analysed using a Pearson’s Chi-square test. This paper documented the association between gender and outcome of embalming process. The level of significance was set at 0.05.

Table 2: Different cases of putrefying bodies brought for embalming at the study areas

DC	HM	NM	EM	CM	FM	UM	FQ	%
LB	2	38	3	13	7	1	64	18.23
CB	5	-	-	4	-	1	10	2.85
DB	4	34	5	32	10	1	86	24.50
PB	1	20	4	7	1	-	33	9.40
IB	2	8	6	10	8	1	35	9.97
AB	-	43	5	21	30	4	103	29.34
BB	-	15	-	2	-	-	17	4.84
RB	-	-	-	-	3	-	3	0.85
Total	14	158	23	89	59	8	351	100

The highest percentage of cases were the putrefying bodies due to accident injuries (29.34%) followed by putrefying bodies due to disease (24.50%).

Key:

HM – Represents data for Hosanna Hospital Modern Embalment Centre, Ekwulumili.

NM – Represents data for Nnewi Diocesan Hospital Modern Embalment Centre, Nnewi.

EM – Represents data for General Hospital Modern Embalment Centre, Enugwu-Ukwu.

CM – Represents data for Chukwuemeka Odumegwu Ojukwu University Teaching Hospital Mortuary, Amaku Awka

FM – Represents data for Hens Funeral Home, Aguleri

UM – Represents data for General Hospital Mortuary, Umueri

DC – Different Cases

FQ – Frequency

LB – Bodies transported over long distances

CB – Bodies putrefying due to chemical/poisons

DB – Putrefying bodies due to certain disease conditions

PB – Autopsy-accelerated putrefying bodies

IB – Improperly embalmed bodies

AB – Accident injury bodies

BB - Burnt putrefying bodies

RB – Putrefying drown bodies

Table 3: Gender of putrefying bodies brought for embalming at the study areas

GENDER	HM	NM	EM	CM	FM	UM	FQ	%
Male	9	113	13	48	48	6	237	67.52
Female	5	45	10	41	11	2	114	32.48
Total	14	158	23	89	59	8	351	100

The male bodies were greater in number than the female bodies

Table 4: Variations of the embalming fluid compositions used for preserving putrefying bodies at the six study areas

FLUID COMPOSITION	HM	NM	EM	CM	FM	UM	FQ	%
Composition A: Formalin + Water + Dye + Glycerine + Methanol	-	158	23	-	-	-	181	51.57
Composition B: Formalin + Water + Dye + Glycerine + Ammonium Salt + Methanol	14	-	-	-	-	-	14	3.99
Composition C: Formalin + Water + Ammonium Salt	-	-	-	89	-	-	89	25.36
Composition D: Formalin + Water + Glycerine + Ammonium Salt	-	-	-	-	-	8	8	2.28
Composition E: Formalin + Water	-	-	-	-	59	-	59	16.81
Total							351	100

A greater number of the bodies were embalmed with ‘composition A’ embalming fluid. The six study areas adopted a certain composition of embalming fluid for the different cases of putrefying bodies. The constituents of the various composition of embalming fluid used by these mortuaries will be represented in “Table 5”. The composition of embalming fluid adopted by the study areas were constant on all the cases of putrefying bodies studied.

Table 5: Contents / Volume of the embalming fluid composition adopted by the study areas

CONTENTS	HM	NM	EM	CM	FM	UM
Formalin (Litres)	30	30	30	30	30	30
Water (Litres)	60	60	60	90	90	90
Dye (Gram)	150	150	150	-	-	-
Glycerine (Litres)	5	5	5	-	-	5
Methanol (Litres)	10	5	5	-	-	-
Ammonium Salt (Gram)	150	-	-	20	-	150
Thymol (Gram)	10	10	-	-	-	-

This table represents the content-to-volume details of the embalming fluid constituents. All the study areas used a 30-litre keg of formalin to prepare its embalming fluid. Two study areas (CM and FM study areas) used a 40% concentration of formalin while other four study areas (HM, NM, EM and UM study areas) used a 20% concentration of formalin. Thymol was used by only two study areas during the rainy season to prevent mould attack. Ammonium salt and methanol are very strong preservatives.

Table 6: Outcome of embalming of putrefying bodies at the study areas

OUTCOME	HM	NM	CM	EM	FM	UM	FQ	%
Success	14	158	60	23	25	4	284	80.91
No success	-	-	29	-	34	4	67	19.09
Total	14	158	89	23	59	8	351	100

There was an 80.91% success outcome reported from the six study areas. Three study areas recorded 100% success outcome with respect to embalming procedures on the male and female putrefying bodies. This outcome was determined from the routine observations after the embalming process. The routine observations on the outcome of embalmmment was recorded using standards observed from the checklist with respect to gender, embalming fluid composition, embalming techniques, management procedures and storage procedures. The scale of assessment on the time of abating putrefaction after proper embalmmment was set at four weeks. Hence, bodies that were still putrefying after four weeks of proper embalmmment were grouped under failed results (outcome).

Table 7: Association between gender and outcome of embalming process at Chukwuemeka Odumegwu Ojukwu University Teaching Hospital (COOUTH) Mortuary, Amaku-Awka

Gender	Success	Failure	Total	Significance
	Freq (%)	Freq (%)		
Male	37 (61.67)	11 (37.93)	48	$\chi^2 = 0.851$
Female	23 (38.33)	18 (62.06)	41	P = 0.035
Total	60 (100)	29 (100)	89	

The putrefying male bodies showed a higher embalming success rate (61.67%) when compared to the female bodies. The male bodies also had a lower failure rate (37.93%) than the female bodies. Pearson chi-square testing found this association between gender and outcome of embalming process significant ($p < 0.05$).

Table 8: Association between gender and outcome of embalming process at Hens Funeral Home Aguleri

Gender	Success	Failure	Total	Significance
	Freq (%)	Freq (%)		
Male	25 (100.0)	23 (67.65)	48	$\chi^2 = 0.967$
Female	0 (0.0)	11 (32.35)	11	P = 0.001
Total	25 (100)	34 (100)	59	

None of the putrefying female bodies were successfully embalmed, in comparison to the putrefying male bodies. The male bodies also had a higher failure rate (67.65%) than the female bodies. Pearson chi-square testing found this association between gender and outcome of embalming process significant ($p < 0.05$).

Table 9: Association between gender and outcome of embalming process at the General Hospital Mortuary, Umueri

Gender	Success	Failure	Total	Significance
	Freq (%)	Freq (%)		
Male	2 (50.0)	4 (100.0)	6	$\chi^2 = 0.749$
Female	2 (50.0)	0 (0.0)	2	P = 0.102
Total	4 (100)	4 (100)	8	

The putrefying male bodies had the same embalming success rate (50%) as the female bodies (50%). The male bodies alone had failed attempts at embalmmnt. Pearson chi-square testing found this association between gender and outcome of embalming process not significant ($p > 0.05$).

Discussion:

This study reveals that 2523 bodies were received at the study areas of which 351 bodies were at the early and middle stages of putrefaction. The evaluation on the 351 bodies noted about eight different cases of putrefying bodies. The cases of putrefying bodies highlighted in this study require special attention and it corresponds to cases identified by (Lord and Goff, 2003; Rao, 2013; Onyejike *et al*, 2017). This study reveals that the highest percentage of cases were the decomposing bodies due to accident injuries (29.34%) followed by decomposing bodies due to certain disease conditions. This suggests that greater attention should be paid on cases of accident injuries and disease conditions during the embalming process. In addition, most of the morticians at the study areas encountered difficulties when embalming accident cases. The gender that was mostly received during this study from the six mortuaries was recorded on males (67.52%). Males recorded high death rate than females. This record may be associated to the high record rate on accident victims received at the study areas because males are predominant in transportation (road activities) business than females especially the tricycles and motorcycles. Hence, it is normal for males to record higher incidence since the highest incidence on cases of putrefying bodies were identified on accident cases. Data on the composition of embalming fluids reveals that composition A and B yielded a 100% embalment outcome compared to composition C, D, E and F. Three mortuaries adopted composition A and B and had a hundred percent (100%) success record. This indicates that the composition of embalming fluid used for embalming putrefying bodies is a major determinant for its outcome. Records from all the study areas show that the mortuaries adopted a particular embalming fluid composition to embalm all the different cases of putrefying bodies received at their centres. About four study areas used an embalming fluid which contains formalin, glycerine and methanol and/or ammonium salt. These constituents contain very strong preservative strength which is in line with Brenner (2014). The ratio for the mixture of these chemicals to water is 1:2. This is also in line with Rao (2013) who outlined the constituent of an ideal embalming fluid. This type of composition is meant to permeate faster into the body and also cause strong preservative effect on the putrefying body. Biswas (2012) also noted that it is ideal to use a 40% concentrated formalin solution to preserve putrefying bodies. This corresponds to the results obtained from two study areas. Goff (2009) noted the

timeline for body putrefaction which outlines that it takes human remains to enter the decay stage of putrefaction at the third week. The outcome of embalming putrefying bodies at the mortuaries for the study was determined by the appearance and nature of the embalmed bodies after three weeks of the embalming process. This theory was adopted on the checklist for setting the scale of embalment outcome assessment to 1 – 4 weeks. This means that it is expected that a standard embalming approach on a putrefying body must halt decomposition by the fourth week. This also indicates that at the fourth week, all the bodies that were still decomposing at the study areas were grouped under failed outcome. However, other determinants for successful outcomes on embalming putrefying bodies are: gender, method of embalment and management of the body. The 100% success outcome recorded by the three study areas was also determined by the management approach used while embalming putrefying bodies. The approach is that the bodies were first placed at a pre-storage medium (where they were first observed for structural / post-mortem changes) before taken to the permanent storage medium. This study identified that this approach helped to abate autolysis and putrefaction on the putrefying bodies. Records from mortuaries with account of failure outcome, reveals poor embalming approach to putrefying bodies. The poor approach is that these study areas lacked a pre-storage medium where putrefying bodies are managed (monitored) before placing on the permanent storage mediums. In addition, the embalming fluid composition used at these study areas had little preservative strength to halt the putrefaction (post mortem changes after proper embalment) even when noticed at the permanent storage medium. The association between gender and outcome was tested using Pearson Chi-square and it showed a significant ($P < 0.05$) test result at Chukwuemeka Odumegwu Ojukwu University Teaching Hospital mortuary, Amaku-Awka and Hens Funeral Home, Aguleri. This showed that gender affects the success the rate of embalming putrefying bodies. However, Pearson Chi-square testing showed no significance ($P > 0.05$) at General Hospital mortuary, Umueri because it accounted for mostly male putrefying bodies. There was more successful outcome on male putrefying bodies compared to female putrefying bodies at the six study areas. This is in line with Clark *et al* (1997), McLemore and Zumwalt (2003) and Goff (2009) who noted that female bodies decompose faster than male bodies.

Conclusion:

This study reveals that the embalming fluid composition that yielded a more successful outcome constituted a mixture of 30 litres of 20% concentrated formalin, 10 litres of 50% concentrated methanol, 150 grams of ammonium salt, 5 litres of glycerine, 60 litres of water, 10 grams of thymol and 150 grams of arterial dye. This embalming fluid composition is suitable for embalming putrefying bodies. The volume of embalming fluid required to preserve a putrefying body is dependent on stage of putrefaction and body mass. Large body volumes require increased embalming fluid volume. Bodies at the skeletal remain stage of putrefaction require increased volume of embalming fluid than bodies at fresh or bloated stage of putrefaction. This means that the stage of putrefaction may also be a determinant for the outcome of embalming putrefying bodies. This study reveals that gender is a major determinant for the outcome of embalming on putrefying bodies in Anambra state. The gender of putrefying bodies that yields a more successful outcome when embalmed using the standard embalming procedure deduced from this study is the males. In addition, accident and autopsy cases require more attention during the embalming compared to the other cases identified in this study. This is because most of the vital organs and vessels might have been damaged yielding to poor circulation of embalming fluid to the different body parts. Hence, the success / failure rate for preserving putrefying bodies is greatly dependent on the gender, embalming fluid composition and management procedures.

Recommendations:

Based on the findings of this study, we proceed to recommend the following:

1. Greater attention should be paid on female putrefying bodies during the entire embalming process.
2. An ideal embalming fluid should constitute a mixture of 40 litres of 20% concentrated formalin, 10 litres of 50% concentrated methanol, 150 grams of ammonium salt, 5 litres of glycerine, 80 litres of water, 10 grams of thymol and 150 grams of arterial dye.
3. After the embalming process, the body should be closely observed (in a temporary storage medium) to detect any post mortem changes arising from putrefaction so as to apply specific measures such as: applying strong insecticides at putrefying areas and the use of injection technique to apply concentrated mixture of

embalming fluid to affected / decomposing areas.

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