

## Design and Layout of Mortuary Complex for a Medical College and Peripheral Hospitals

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### Abstract

The mortuary is the most neglected and ignored place in almost all the peripheral hospitals as well as medical colleges. It is not having even basic facilities for the departed souls, public and officials working there. It is a well-known fact that from the overall expenditure of any hospital, a very minute share is spent on the autopsy facility; it being considered a necessary evil. Consequently, the overall environment in a mortuary is depressing and gloomy; this situation is further compounded by administrative apathy towards medico-legal work as a whole. Despite these setbacks, a ray of hope emerges from judicial judgments on this issue. Keeping in view these points along with judicially pushed compulsion on the authorities to streamline and improve mortuaries, we present a lay out for the ideal mortuary complex designed for medical colleges and peripheral hospitals.

**Keywords:** Autopsy complex; Post-mortem examination; Forensic facilities

### Introduction

The mortuary is a place of mystery, sadness, grief or repulsion and all hope, while alive, that they will never need to visit such a place. For families who have lost a loved one to a sudden death, this becomes a reality [1]. Working in a mortuary is an extremely stressful experience which is made worse in India due to the large number of people dying sudden violent deaths due to trauma and the pitiable condition of mortuaries throughout the country.

Globally, several government and private agencies have conducted research interviews with the working staff regarding the working conditions of mortuaries. The themes which emerged from the interviews with mortuary staff were; secondary trauma for families, delays by health professionals and dehumanized mortuary staff. There is a need for a change in the way bereaved families are being managed as well as revision of the environment for the staff working in mortuaries [1].

With this background, we now discuss the functioning of a mortuary attached to hospitals in India. For primary level hospitals (primary/community health centers), usually no provision of post-mortem examination exists. All cases are referred to the nearest Secondary level hospital (General/Civil hospitals) for post-mortem examination. All medico-legal work including autopsies for the district is carried out on behalf of the Civil Surgeon by Medical Officers posted there. Complicated cases/cases requiring re-examination are further referred to the Tertiary level hospitals (i.e. Medical colleges), where autopsy work is conducted by the department of Forensic Medicine. This hierarchy is prevalent throughout the country except for a few anomalies here and there. Still any sort of regularity and standardization eludes autopsy work as no standard design or guidelines are outlined for construction of mortuary complexes.

### Role of an ideal mortuary complex

The services provided by a Forensic facility's comprehensive morgue and postmortem component are: [2]

- Specimen handling area
- Administrative functions (documentation of incoming or outgoing bodies report preparation)

- Receiving, preparation and temporary storage of cadavers.
- Investigations into the cause of death by performing a PM examination of the body (including forensic autopsies).
- The demonstration of PM findings in cases of clinical interest, for teaching or forensic purposes.
- Mobile radiography.
- Photography.
- Family/police viewing and/or identification of the body.

General considerations of design and equipment apply equally to various types of mortuary units, both hospital and public; [3] therefore there are slight differences in both elements while making a layout for secondary and tertiary level hospitals. However the overall design of an ideal mortuary satisfies both scenarios.

### General guidelines for mortuary designs

Every mortuary should have following minimum facilities:-i) arrangements for receiving the dead bodies from the hospital or from outside, with separate arrangements for keeping decomposed and infectious bodies (known HIV/hepatitis death cases) etc. ii) for performing autopsies; iii) Handing over the dead bodies after postmortem examination to the relatives/ undertakers through police; iv) postmortem viewing gallery for the students /IO /nominees as per court orders etc.; v) other basic essential requirements like offices and related rooms as detailed below. These all should have basic office facilities like furniture, telephone and other infrastructure, etc. as per need for smooth functioning.

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The design of the teaching mortuary was prepared keeping in view the intake of students in a medical college, workload, condition of the various bodies being brought for postmortem examination and to have workable atmosphere as to cleanliness & breathing with fresh air and natural light to be available in each room of the mortuary.

The mortuary complex must be located at a short distance from the hospital, at a sight which is secluded but easily accessible. There should be a direct link between the hospital and the mortuary to facilitate easy delivery of the dead bodies for autopsy from the wards. It should have adequate parking space. It should be preferably centrally air conditioned.

### **Mortuary for a tertiary level mortuary complex**

The teaching mortuary complex must consist of the following (Appendix- A)

1. Veranda should be in front of the faculty office, autopsy surgeon room in which these should open and working windows for the reception room on both sides.
2. Faculty office with an attached toilet.
3. Autopsy surgeon's room (size 14x20 sq. ft.): where the Autopsy surgeon /medical officer can discuss details of the case with police and relatives and write reports peacefully without any disturbance.
4. Computer Room & Office (12x10 sq. ft): with furniture, computer, printer cum scanner, photography instruments etc.
5. Stores-I (12x10 sq. ft) for clean gowns, aprons, rubber gloves, gumboots, towels etc.
6. Reception/ room for mortuary supervisor (12x14 sq. ft.): where inquest papers are received and details are entered in a register. There should be a counter with glass panel and working window on the sides with access to the doctor's room.
7. Toilet for general public.
8. Investigating officer /Police Room (10x10 sq. ft.) for the police personnel accompanying the body who has to watch and take care of the dead bodies in the mortuary complex.
9. Veranda/shade for trolley etc.
10. Class IV Rooms (8x10 sq. ft.); it has lockers etc. and used as changing place for them.
11. Toilet for staff.
12. Walled enclosure with gate.
13. Pre Autopsy Room (16x20sq. ft): / the capacity of the cold storage room should be depending upon the number of the dead bodies (for keeping 10-15 bodies) before the post-mortem examination. As soon as the police brought the body in the mortuary it should be kept in this room with complete identity. This should have cold storage facilities (cold chambers in the form of refrigerated cabinets) with a temperature maintained between 4-6.5°C. Adequate space for keeping the extras dead bodies on the trolleys, if needed, should be there.
14. Post Autopsy Room (14x18 sq. ft.): should have a central platform (4x8 sq. ft.) for handing over the body to the investigating officer who subsequently handover the body to the relatives for final disposal after completion of the post-mortem examination.
15. Gate for open mortuary; the gate should be of sliding type.
16. Teaching Autopsy Room I: the size of the autopsy rooms should be depending upon the intake of the students and at least it should be 400 Sq. Meters or more. It should have at least two mortuary tables preferably of stainless steel with arrangements for free drainage of a constant flow of water from top to bottom. A proper vent and duct system needs to be installed for exit of foul smelling gases and entry of fresh air. Each room should have mortuary work station. This room should be constructed in such a way that they should have big windows up to the level of roof with glasses, if, possible facing the east, south and west, so that the maximum adequate sun light may remain in the rooms. There should be large charts depicting weights and measurements of viscera, bones etc. for quick reference for autopsy surgeon. There should be X-ray view boxes in these rooms for seeing x-ray film etc. Portable x-ray machine should be available. The floors should be constructed of materials like granite and walls with epoxy which facilitate easy cleaning with a slope to a main drain. The viewing gallery for the students shall be constructed around the autopsy tables depending upon their strength in both teaching autopsy rooms. The doors should be fly proof.
17. Teaching Autopsy Room II (of same specifications as above).
18. Space for open mortuary /maceration tanks/open research lab; (with roof covered with net) for the decomposed bodies and other ancillary work. This space should be all around both the teaching autopsy rooms so that public cannot have an access to the ongoing postmortem in these rooms;
19. Instrument Room (8x10 sq. ft.): instrument cleaning room to be provided for the thorough cleansing of all numbered instruments / equipments between the two autopsy rooms;
20. Viscera Preparation Room (12x10 sq. ft.) where the technician / mortuary attendant can do the assigned job under the supervision of the medical officer. It should be near to the autopsy rooms;
21. Stores-II (12x10 sq. ft.) for reserve stocks of and chemical solutions for preserving the viscera and packing materials etc.
22. Stairs and side gate.
23. Officer's toilet; (8x12 sq. Ft.) One separate male and female W.C. lavatory, basin and a shower cubical are needed.
24. Doctors changing room: there must be two changing rooms (12x10 sq. ft. each) having bath with shower for autopsy surgeons and with lockers for male and female officers.
25. Green belt: this is required to make mortuary complex eco-friendly.
26. Corridors & Verandas' all around: these will help not only in free movement of the functioning officials in the premises of mortuary but also in cases of emergency of handling of mass disaster cases and will provide more space for decomposed gases to spread and exit.
27. Waiting area for attendants of the relatives of the deceased with seating arrangements and provisions of drinking water and toilets.
28. Main Gate; preferably it should be sliding type.
29. Open space for parking for vehicles bringing and carrying the dead body.

## Mortuary for a secondary level hospital

The peripheral hospital mortuary complex must consist of the following (Appendix- B)

1. Medial officer's room (size 14x20 sq. ft.): where the medical officer can discuss details of the case with police and relatives and write reports. It has an attached bath cum toilet (8x12 sq. Ft.). One separate male and female W.C. lavatory, basin and a shower cubical are needed. It has two changing rooms (12x10 sq. ft. each) with lockers for male and female medical officers. It has a veranda in its front. Tables and chairs with almirahs and lockers should be available as per requirements. Telephone facilities must be there.
2. Computer Room & Office (12x10 sq. ft): with furniture, computer, printer cum scanner, photography instruments etc.
3. Record Rooms with file cabinets.
4. Reception Room (12x14 sq. ft.): where inquest papers are received and details are entered in a register. There should be a counter with glass panel and doors on the sides with access to the medical officer's room.
5. Police Room (10x10 sq. ft.) for the police personnel accompanying the body who has to watch and take care of the dead bodies in the mortuary complex;
6. General Toilets.
7. Veranda Connecting reception and doctor's Room;
8. Toilets cum Bath with shower for Medical officers;
9. Toilets for Staff;
10. Class IV Rooms (8x10 sq. ft.); it has lockers etc. and used as changing place for them.
11. Stores-1 (12x10 sq. ft) for clean gowns, aprons, rubber gloves, gumboots, towels etc. adjacent to the medical officer's room.
12. Stores-2(12x10 sq. ft.) for reserve stocks of and chemical solutions for preserving the viscera and packing materials etc.
13. Viscera Preparation Room (12x10 sq. ft.) where the technician / mortuary attendant can do the assigned job under the supervision of the medical officer.
14. Pre Autopsy Room (16x20sq. ft): / cold storage room meant for keeping 5-10 bodies before the post-mortem examination. As soon as the police brought the body in the mortuary it should be kept in this room with complete identity. This should have cold storage facilities (cold chambers in the form of refrigerated cabinets) with a temperature maintained between 4-6.5°C. Adequate space for keeping the extras dead bodies on the trolleys, if needed, should be there.
15. Autopsy Room 1: (sized at least 400 Sq. Mtrs.); it should have two mortuary tables preferably of stainless steel with arrangements for free drainage of a constant flow of water from top to bottom. A proper vent and duct system needs to be installed for exit of foul smelling gases and entry of fresh air. Each room should have mortuary work station. This room should be constructed in such a way that they should have big windows up to the level of roof with glasses, if, possible facing the east, south and west, so that the maximum adequate sun light may remain in the rooms. There should be large charts depicting weights and measurements of viscera, bones etc. for quick reference. There should be X-ray

view boxes in these rooms for seeing x-ray film etc. Portable x-ray machine should be available. The floors should be constructed of materials like granite and walls with epoxy which facilitate easy cleaning with a slope to a main drain.

16. Autopsy Room 2 acts as an open mortuary (with roof covered with net) for the decomposed bodies and other miscellaneous work.
17. Instrument Room (8x10 sq. ft.): instrument cleaning room to be provided for the thorough cleansing of all numbered instruments / equipments between the two autopsy rooms.
18. Post Autopsy Room (14x18 sq. ft.): should be in the form of a covered area with central platform (4x8 sq. ft.) for handing over the body to the police and cleaning /covering of the dead body by the relatives after completion of the post-mortem examination.
19. Open Space (Green belt)
20. Walled enclosure with gates.
21. Corridors & Verandas.
22. Shades for public and other facilities: for the relatives of the deceased with seating arrangements and provisions of drinking water and toilets.

## Miscellaneous requirements

- (a.) **Floors:** should be hard and durable. It should be made from material which is moisture resistant and can be easily cleaned. Floor ducts and trenches should be avoided in the autopsy rooms and pre-autopsy rooms. The junctions between the walls and floors should be suitably covered.
- (b.) **Walls:** the walls of the mortuary should be thick, durable and permanent. The walls should be fitted with pale blue color tiles up to the ceiling so that natural colors of the dead body can be appreciate as in day light.
- (c.) All doors in the mortuary complex should be wide sliding type and fly proof.
- (d.) **Windows:** the mortuary should have sufficient natural light. The windows of the mortuary should be preferably on the east, south and west sides whenever possible for receiving maximum sunlight. They should have glass. Windows sills should be at least 5 ft. above the floor and go up to near the ceiling.
- (e.) **Corridors:** the corridors of the mortuary limit should be wide to allow passage of trolleys. (Not less than 8 ft.)
- (f.) **Lighting:** the light fitting should be designed to avoid glare, and should be easy to clean and maintain. In the mortuary either tungsten or florescent lighting can be used. Switches in wet area should be hose proof. Special lighting should be provided in the post-mortem room to ensure adequate illumination of post-mortem tables and dissection benches. The wall between the two mortuary rooms should have glass on their upper three feet area so that the natural light may pass to either room. The height of these rooms should be optimum preferably twenty feet.
- (g.) **Hot and cold water supply:** hot and cold water be required in the sinks, wash-basins and showers. The post-mortem tables should be fitted with individual /water hoses. Water suction pumps should not be used. Floor service ducts should be avoided. All the taps in the mortuary complex should be of elbow operated type particularly in the working area.

- (h.) Air conditioning: the entire complex should be air conditioned with a separate system for the autopsy rooms to prevent foul air permeating the rest of the area. No air should be re-circulated in the mortuary in order to ensure a clean air environment.
- (i.) **Safety:** the complex should be fitted with emergency lighting, fire sprinklers and smoke/thermal detector in all rooms. A fire alarm system with blue /red beacon light with hooter should be installed. Fire exit routes should be clearly identifiable, well illuminated and earmarked with bold red arrows.
- (j.) **Refrigeration:** the temperature of cold rooms is to be maintained between 4°C to 6.5°C, thermostat control will be required for each cold chamber. Facilities should be provided to enable the chambers which are not in use to be switched off.
- (k.) Proper disposal of waste: the mortuary complex should have all the arrangements for disposal of different types of waste products. Cleanliness and sanitation in and around the mortuary should be maintained properly and adequately.
- (l.) Measurements of the space may be adjusted depending upon the requirements and workload. The mortuary complex must have different sign boards like “No Admission”, “Prohibited Area” etc.

Along with the above mentioned general requirements specific emphasis must be made on aeration and ventilation of the mortuary. According to a report by The American Institute of Architects Academy of Architecture for Health; U.S. Department of Health & Human Services on Ventilation Requirements for Areas Affecting Patient Care in Hospitals & Outpatient Facilities, the design of the ventilation system should provide air movement which is generally from clean to less clean areas. To satisfy exhaust needs, replacement air from the outside is necessary. Number of air changes may be reduced when the room is unoccupied if provisions are made to ensure that the number of air changes indicated is re-established any time the space is being utilized. Adjustments shall include provisions so that the direction of air movement shall remain the same when the number of air changes is reduced. Air from areas with contamination and/or odor problems shall be exhausted to the outside and not re-circulated to other areas [4].

## Conclusion and Future Advancements

Safety and security are integral components of a forensic facility.

Defining public areas from secure zones to ensure the secure custody of sensitive items such as case files, evidence, and human remains is critical [5]. The concept of a modern and ideal mortuary will protect the occupants against diseases emanating from filthy and unhealthy environment and the mortuary contents against destruction from decay of unrepaired and neglected mortuary buildings.

Advanced technology should be incorporated to ensure that the service provision continues to meet the highest standards in forensic science and medico-legal death investigation. Tele-medicine facilities can be envisaged in the modern mortuary complex using large training areas and various meeting rooms with video conferencing capability to promote collaboration and improve educational opportunities; to collaborate with colleagues and clients within the province and around the globe, in on-line meetings, for educational sessions incorporating digital images (including microscopy), and during day-to-day forensic consultations. Advancements in diagnostic imaging are now recognized as valuable tools for death investigators. CT, MRI, and digital x-ray technology should be an integral component available to the mortuary staff. This emerging trend has become standard practice in some global jurisdictions to augment the medico-legal autopsy, and in some cases, as an alternative to limit invasive procedures for operational or religious reasons. An ideal mortuary will undoubtedly contribute to the advancement and evolution of forensic science and medicine, strengthening the relationship between service, teaching, and research. The public safety network and criminal justice system will benefit tremendously and will now be supported by a forensic facility built to match the level of excellence required.

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