CHAPTER 4

THE PREPARATION ROOM

CHAPTER OBJECTIVES

- Preparation room design
- Preparation room equipment
- Preparation room requirements
- Instruments
- Preparation room supplies

Each funeral establishment may have a preparation room or funeral homes with several branch operations may have the embalming done at one location. A newer concept is the independent centralized embalming facility. These centralized embalming centers are shared by several funeral homes in a community. Where central facilities are used, funeral establishments can maintain a **holding room** for cosmetizing, dressing, and casketing the bodies after they have been delivered from the embalming center. Some states require that each funeral facility maintains a preparation room even if a central embalming facility is used.

▶ OBJECTIVES

The primary purpose of a well-designed and organized preparation room is to provide a safe and comfortable workplace. It should also be available to serve as a public relations tool if a community group wishes to tour the funeral establishment. A tour that does not include the preparation room can only serve to heighten unfounded suspicions and misconceptions concerning the embalming process.

In planning remodeling or new construction, emphasis should be placed on making the area functional and efficient. A layout that saves a few steps can save many working hours in the course of a year. A door planned to be just barely wide enough to accommodate the removal cot or a casket can be a source of annoyance, inconvenience, and irritation long after the small extra cost of a slightly wider door is forgotten. This room needs to be a clean, comfortable, and efficient workplace.

▶ PREPARATION ROOM CONSIDERATIONS

General Rules

1. Preparation room is kept strictly private during body preparation. Persons admitted should be limited to:
   a. Licensees and registered trainees.
   b. Those authorized by the family.
   c. Those authorized by state statute or rules and regulations.
2. Limited authorized persons can be in the room when preparation work is not being performed:
   a. Maintenance employees.
   b. Hairdresser, cosmetologist, barber, persons with other responsibilities.
   c. Staff members for dressing and casketing remains.
3. Identify the room by signage:
   a. Strictly private area.
   b. Occupational Safety and Health Administration (OSHA) warnings.
4. Secure the preparation room:
   a. State regulations may require security locks.
   b. Establish a security plan for the handling of the remains of high-profile persons.
   c. Inventory and label personal effects.
   d. Preparation room should not be located so that it becomes a passage to other building areas.
5. Maintain the dignity of the remains. Be sure that:
   a. The body is properly identified.
   b. The remains are covered.
   c. A modesty cloth is used during preparation.

6. Maintain highest moral standards.
   a. Keep body covered as practical.
   b. Guard loose talk and remarks.
   c. Repeat nothing outside of preparation room.
   d. Disclose no confidential facts as to age, condition of the body, deformities, or diseases causing death.
7. Maintain a clean and healthy environment.
   a. Properly dispose of clothing of the deceased: (1) launder and return to the family; or (2) destroy after proper authorization.
   b. Proper disposition of all waste (see Chapter 3): Statutes, rules, and regulations vary for individual states.
   c. Be sure ventilation, heating, and cooling systems work properly.
   d. Maintain all mechanical apparatus so no leakage occurs.
   e. Perform and document regular maintenance and cleaning of the preparation room.
8. Maintain an adequate supply of chemicals and sundries necessary for preparation work, restorative, and cosmetology treatments.
9. Maintain an adequate number of tables and positioning devices; this will help to keep movement of bodies minimal.
10. Document through the use of a decedent care report each deceased human body that comes into the custody of the facility.

▶ REGULATIONS

Funeral home facilities are governed by a variety of laws and regulations from federal, state, and local agencies because they are public places of business and employ workers in a workplace. A brief review of the major sources of regulations governing the preparation room environment follows, and throughout this chapter, reference is made generally to standard requirements. Funeral home owners are advised to consult experts in the legal and construction fields to be certain that their facilities, planned or existing, conform to all local requirements.

OSHA Requirements

The federal OSHA prescribes in detail the physical and environmental requirements that employers must meet to provide a safe workplace. These requirements are enforced through workplace inspections, warnings, and citations. In the event of failure to correct continual noncompliance or serious violations, substantial fines are levied. A well-known example is the Hazard Communication Standard.

Lesser known requirements have to do with the necessity for an adjacent shower and locker facility, electrical grounding, ramp and stair-step angles and heights, and a host of other areas of concern to the worker. Caution should be exercised to be certain that **all** OSHA requirements are being met in the workplace.

Four areas of OSHA directly impact the funeral service practitioner: (1) OSHA General Rule; (2) Hazard Communication Standard; (3) Formaldehyde Standard; and (4) Blood-borne Pathogen Standard (see Chapter 3).

"Right to Know" Laws

An emerging area of legislation on the local and state levels is "right to know" legislation. This is directed at employers and requires them to post information warning employees of chemicals that may be hazardous or harmful to their health and well-being. Firms in locales that have enacted such legislation may have to meet these requirements as well as those of OSHA.

Building Permits

All construction of any magnitude requires that a building permit be obtained from local authorities. The application procedures usually require that detailed plans and specifications be submitted regarding plumbing, electrical, and other construction materials to ensure that all materials and construction meet certain minimum standards. A competent architect, contractor, or both should be consulted prior to permit application in a particular locale.

State Codes and Local Ordinances

State boards of health and mortuary science have enacted regulations governing the minimum standards for preparation rooms. The Board of Embalmers and Funeral Directors of Ohio is an excellent example of state rules and regulations setting the minimum facility and equipment standards for the preparation or embalming room.

Ohio. Chapter 4717-1-16. "If embalming will take place at the funeral home, the funeral home shall maintain on the premises a preparation room which shall be:

- adequately equipped
- maintained in a sanitary manner for the preservation and care of dead human bodies.

Such rooms shall:

- contain only articles, facilities, and instruments necessary for the preparation of dead human bodies for burial or final disposition
- be kept in a clean and sanitary condition
- shall be used only for the care and preparation of **dead human bodies**

The minimal requirements for the preparation or embalming room shall be as follows:

1. Sanitary floor (cement or tile preferred).
2. All instruments and appliances used in the embalming of a dead human body shall be thoroughly cleansed and sterilized using an appropriate disinfectant immediately at the conclusion of each individual case.
3. Running hot and cold water with a lavatory sink for personal hygiene.
4. Exhaust fan and intake vent, permanently installed and operable with the capacity to change the air in the room **fifteen times each hour**.
5. Sanitary plumbing connected with sewer, cesspool, septic tank, or other department of health approved system.
6. Porcelain, stainless steel, metal-lined, or fiberglass operating table.
7. All opening windows and outside doors shall be adequately screened and shielded from outside viewing.
8. All hydro-aspirators shall be equipped with at least one air breaker.
9. Containers for refuse, trash, and soiled linens shall be adequately covered or sealed at all times.
10. First-aid kit and eyewash.
11. The embalming or preparation room shall be strictly private. A "private" sign shall be posted on the door(s) entering the preparation room. No one shall be allowed therein while the body is being embalmed except the licensed embalmers, licensed funeral directors, apprentices, officials in discharge of their duties, and other authorized persons.
12. All waste materials, refuse, used bandages, and cotton shall be destroyed in accordance with all applicable OSHA and EPA regulations.
13. Every person, while engaged in actually embalming a dead human body, shall be attired in a clean and sanitary smock or gown covering the person from the neck to below the knees and shall wear impervious rubber gloves, and shall wear any and all items required under any applicable OSHA regulations.
14. All bodies in the preparation room should be treated with proper care and dignity and should be properly covered at all times.
15. Ingress and egress of the preparation room must be situated so that functions in the funeral home will not impede or interfere with entering or exiting said room.
16. Sufficient emergency lighting.

HOLDING ROOM. The state of Ohio has also set rules for a "holding room." A "holding room" is not used for embalming. Its use would include:

- cosmetic, restorative treatment, and dressing of embalmed bodies received from a central embalming facility or shipped from another location
- preparation of bodies for identification without embalming
- storage of embalmed or unembalmed bodies
- cavity embalming which may include aspiration or reaspiration of a body

The rule is as follows, "If embalming will not take place at the funeral home, the funeral home shall maintain on the premises a **holding room** which shall be adequately equipped and maintained in a sanitary manner for the holding of dead human bodies. Such holding room shall be kept in a clean and sanitary manner and used only for the holding and storage of **dead human bodies.** The minimum requirements for the holding room shall be as follows:

1. Sanitary floor;
2. Running hot and cold water with a lavatory sink for personal hygiene;
3. All opening windows and outside doors shall be adequately screened and shielded from outside viewing;
4. Containers for refuse, trash, and soiled linens shall be adequately covered or sealed at all times;
5. The holding room shall be strictly private. A "Private" sign shall be posted on the door(s) entering the room. No one shall be allowed therein while the body is being held except the licensed embalmers, licensed funeral directors, apprentices, officials in discharge of their duties, and other authorized persons;
6. All bodies in the holding room should be treated with proper care and dignity and should be properly covered at all times;
7. Ingress and egress of the holding room must be situated so that functions in the funeral home will not impede or interfere with entering or exiting said room.

If the holding room is equipped with a hydro-aspirator or electric aspirator, the aspirator shall be equipped with at least one air breaker."

Extensive planning and consultation are required in advance of any construction in the funeral home in general and the preparation room in particular. There are several national architectural firms that specialize in the design and construction of funeral facilities. Funeral home owners, as business people serving the public and employing people in the workplace, have special

obligations that must be met. Individual state statutes, rules, and regulations along with local city, and county ordinances must be consulted for up-to-date compliance with respect to the preparation room, holding room, and refrigeration facilities.

The funeral home or embalming facility may wish to have its own set of regulations. These might include such items as (1) persons who may have egress to the room; (2) cleaning schedules; (3) scheduled disposition of medical and non-medical waste; (4) responsibility for stocking and ordering inventory; (5) machine maintenance schedule; (6) protocols for disinfecting and cleaning of instruments, drains and machines.

▶ PREPARATION ROOM LOCATION

Basement

The basement is often where space is most readily available, although frequently this is not the most desirable site. Ceiling height is the most common difficulty in this area because of overhead pipes as well as heating and air conditioning ducts. Sometimes, pipes and ducts may be diverted, run between floor joists, or sometimes concealed in wall cabinets. Lighting fixtures may also be kept from lessening head room if they are recessed between floor joists.

Plumbing can present vexing questions if sewer drains are substantially above floor level. Ventilation and air conditioning are more costly in basement areas. Stairs can be a considerable inconvenience—even a hazard. An elevator, lift, or ramp may offer a solution here.

A wet basement might be the greatest single deterrent to using this area. Normal dampness is rather easily handled by a dehumidifier, and it is essential that this be done.

First or Second Floor

The first floor is usually the most logical and least costly location of a preparation room if ample space is available. Natural daylight is normally available to create more pleasant working conditions; however, other considerations now arise. Access to the room should be from a non-public area. If the room is adjacent to a public area, such as the selection room, adequate soundproofing is extremely important. If this is impractical or impossible, a flashing light should be installed in the preparation room to alert staff members that a family is in the next room. Odor control and proper exhaust venting must be provided. Those who work in a funeral home become accustomed to certain odors that would be obvious and objectionable to a visitor.

If the installation of an elevator is feasible in a two-story building, the second floor may well be the best of the several alternatives. More natural light is available, and ventilation is less expensive and more effective. Normally, a second-floor room is completely removed from the public areas. Here again, sound levels must be considered. Plumbing may be non-existent in the immediate area, but totally new plumbing may be reasonable considering the other advantages to be gained.

▶ PREPARATION ROOM SIZE

The size requirement of the preparation room is of critical importance in determining the location. A room that is too large can necessitate extra steps and encourage use of the surplus space for storage. Many problems can be forestalled by partitioning a part of the area for planned storage. Allow adequate work space but keep all equipment, instruments, and supplies readily accessible.

The firm that conducts as many as 100 funerals annually should find one permanent table ample. A folding table will serve in an emergency and can double as a dressing table when required. An area 120 to 150 square feet for this room should be considered a minimum. This should allow for ample cabinets and counter space, assuming the room is not an unusual shape and that it does not have more than one or two doors opening into it. When locating plumbing for the table, keep in mind the need to allow ample passage for the removal cot and for a casket, if casketing is to be done in the preparation room. Doors and corridors leading to the room must also be of ample width, especially if turning corners is required.

A firm anticipating 100 to 150 funerals per year should try to provide a bit larger area if at all possible. One table would normally still be adequate, but the extra folding table is essential.

A firm contemplating 150 to 350 funerals annually should provide a minimum area of approximately 400 square feet and two completely equipped tables. A firm doing a larger volume should seriously consider a separate dressing room where hairdressing and cosmetizing may be done.

Some considerations when remodeling or building new might include

- Once volume of use is determined, keep the space where the embalming operation will be performed as small as is practical.
- Minimum operating spaces saves steps.
- Minimum operating spaces are easier to keep sanitary.
- Minimum operating spaces are easier to ventilate, heat, and cool.
- Keep instruments, fluids, and sundries in convenient locations within the area of operation; storage spaces should be placed so bending is not necessary.

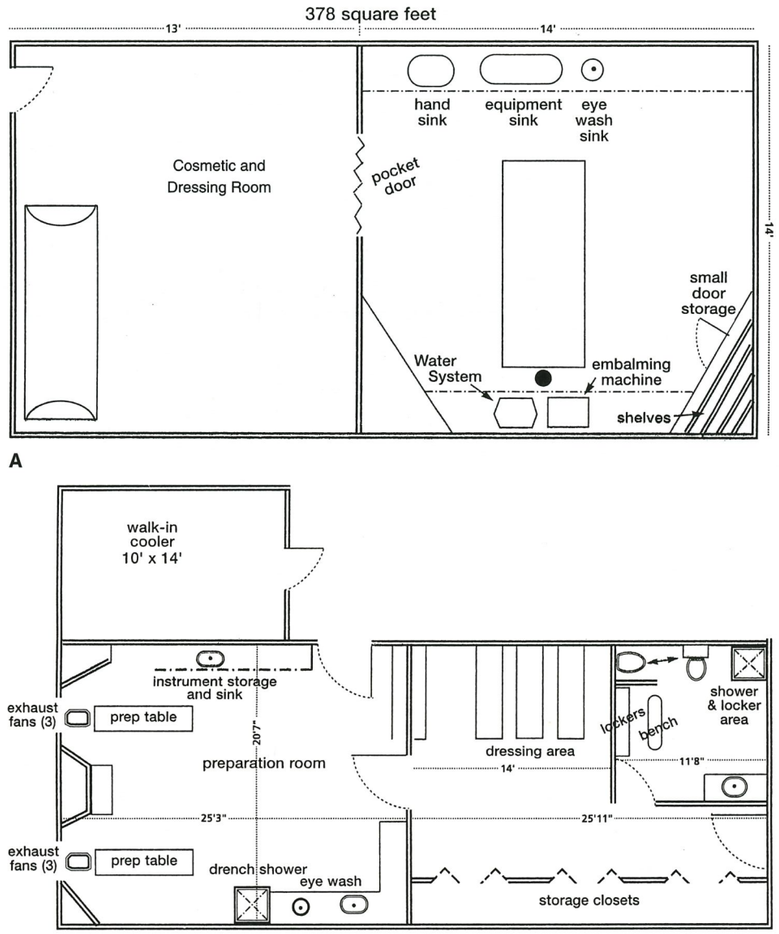

Figure 4–1. A, B. Flooring plans showing use of the "station or booth concept." (*Continued*)

- Lifting devices should be used for moving bodies.
- Adequate tables will decrease the necessity to move bodies; ideally, once the body is placed on a preparation table, it should not have to be moved until it is placed in a casket, shipping container, or on a cot.
- Floors, countertops, and all flat surfaces should be constructed of materials that can easily be sanitized.

The **"station" or "booth"** concept in embalming room design uses one or more fully equipped small operating areas (within a large preparation room) where the embalming is performed. The room space adjacent to the embalming stations is where restorative work, cosmetizing, hairdressing, dressing, and casketing of the remains are performed. The small operating stations are more private and, because of their size, easily sanitized and cleaned. The number of preparations performed per year determines the number of stations that should be constructed. One station for each 150 preparations has been suggested. The following floor plans #1 (Fig. 4–1A) and #2 (Fig. 4–1B) show the use of the "station concept." Floor plan #3 (Fig. 4–1C) is suggested for a central embalming facility or an embalming facility within a large funeral establishment. Note that this plan includes a covered delivery and receiving area, walk-in cooler for storage, crematory facility, "station" preparation area, dressing and casketing areas, and an employee restroom, shower, and changing area.

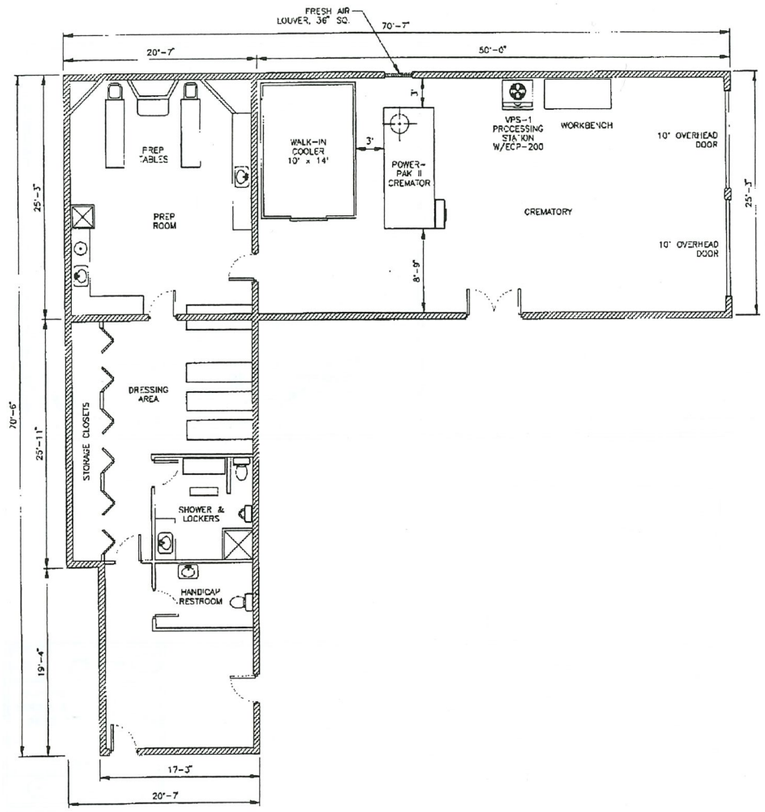

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Figure 4–1. (*Continued*) **C.** Flooring plan suggested for central embalming facility or an embalming facility within a large funeral establishment.

▶ PHYSICAL DESIGN

Discuss the requirements with an architect for a new building or when remodeling. Show the architect the existing equipment and describe the movement made in the room. Consider plumbing needs. Plumbing costs should not always be the overriding determining factor.

Maneuverability within the finished room is tremendously important. When the tentative location for the table(s) is set, mentally go through the motions of getting the removal cot and the casket into the room. Once the general plan seems satisfactory, draw the room to scale with all equipment in place and think again about all the movements that must take place in the finished room.

Storage Cabinets and Countertops

Next, consider storage cabinets. Although space should be provided for working quantities of supplies, the preparation room should not double as a storeroom. Ready-made base cabinets are generally 24 inches deep. Obviously, these would normally be the least costly. Depending on the size and shape of the room, however, custom cabinets may be a necessity. They could be 18 or 12 inches deep, if space is very limited. If the space is such that cabinet depth is not a problem but counter length is limited, it might be desirable to use a stock 24-inch cabinet and hold it out from the wall to permit a 30-inch deep countertop. The vacant space behind the cabinets might be used for water pipes or electrical wiring.

Table Arrangements

There are virtually as many table arrangements as there are sizes and shapes of rooms; however, two are the most common and popular.

Conventional Parallel Table Plan. The conventional parallel table plan is a perfectly functional layout, although it may not be the best choice because the exhaust system,

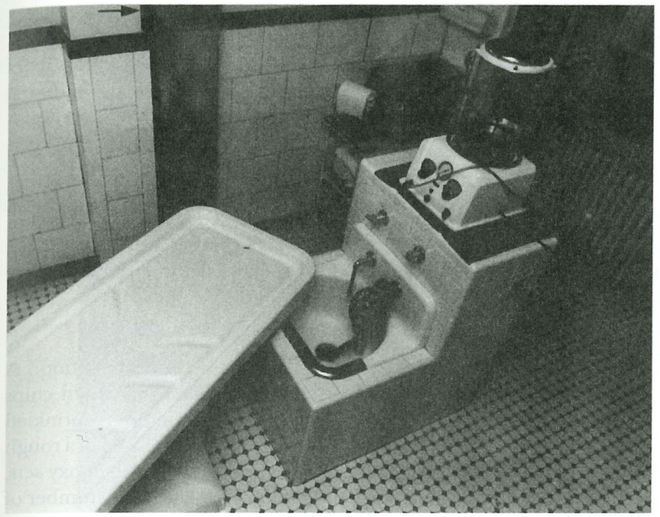


Figure 4–2. Island preparation design. Note the duct for exhaust that pulls fumes to the floor, away from the embalmer.

depending on where it is placed, may draw odors past the embalmers. With this plan, caution must be taken against making the waste sink a part of the cabinet line. This makes the sink and surrounding areas more difficult to clean. Instead, mount the sink on the face of the base cabinets or on the floor, leaving some clearance between the sink and cabinet.

The "island" cabinet (Fig. 4–2) gives the embalmer freedom to pass completely around the table without stepping over hoses and electric cords. No part of the wall storage cabinets is obstructed. All plumbing connections are within the cabinet and readily accessible if a problem should arise.

Two-Table Room Arrangement. If a sufficiently large square or rectangular room is available, the two-table room arrangement is preferred. It provides two completely separate work areas, allows maximum flexibility in movement within the room, and generally does not interfere with doors.

Flooring. After the location of the preparation room in the building and the layout of the room itself have been considered, perhaps the first specific aspect of the room that should be discussed is the floor.

The floor must withstand very heavy traffic and considerable static weight. If selected carelessly, it can harbor infectious organisms, cause anything on wheels to roll toward low spots, cause glare, and create difficult working conditions or perhaps require recovering or even structural repair sooner than it should. The architect must be made fully aware of the weights this floor will hold and, therefore, the amount of structural support necessary. Flooring should be resistant to scuff marks and stains. Dyes in embalming fluids should be easily removed. Light-colored flooring puts more brightness in the work area. A matte finish to the floor is more desirable than a glossy finish. The matte finish produces less glare, shows fewer scuff marks, and is easier to maintain than a glossy finish.

Basement Preparation Room

It is essential that the proper base be laid for any cement floor. There should be a thick stone bed covered by vinyl vapor barrier sheeting underneath the cement. A small ditch should be constructed around the outside, with ample leach lines to feed into the ditch in case water does start to collect. The cost of a small sump pump might well be worthwhile. Located in an out-of-the-way spot, it would pick up and discharge any water accumulation. Building codes should be consulted.

If the preparation room is located in a basement with a cement floor, it is best to cover it with something; standing on cement is uncomfortable. Building a wood floor over the cement is a common answer to this problem. If the wood floor were built directly on top of the concrete, moisture would cause it to rot. Therefore, various methods are used to raise the wood floor and leave an air space between it and the concrete. In addition to preventing rot, the space acts as an excellent sound absorber. Any wood floor needs to be covered with a non-absorbent material.

It is also important to have enough floor joists and a thick enough wood subfloor to support the heavy concentrated weight the floor will bear. Try to anticipate locations for desired electrical and plumbing lines before closing up the floor.

First or Second Floor Preparation Room

When building a preparation room on the first or second floor, the architect should again be cautioned about the loads that the floor must support. An embalming table can weigh 300 or 400 pounds and that, plus the weight of a subject, could create a low spot on an insufficiently supported floor. The floor's sinking, in turn, can cause cracking of tiles or other floor coverings. Over a span of 12 feet, a normal floor (without a bearing wall) could use 2 × 10-inch timbers on 16-inch centers for floor joists; however, a preparation room with 2 × 12-inch timbers on 12-inch centers is preferred. Alternatively, to keep timber height uniform with that of adjoining rooms, the 2 × 10-inch timbers on 16-inch centers should be doubled.

▶ FLOOR COVERING

Terrazo Floor

A terrazo floor is one sort that might be considered for this application. It is a natural polished floor that is very durable and easy to maintain. Terrazzo is very hard and, therefore, tiring to stand on for extended periods. Also, it is slippery when wet. This problem can be overcome with the use of rubber mats.

Clay and Ceramic Tile

Clay and ceramic tile are both excellent choices. The size of such tiles makes a very important difference. The large 4 × 4-inch tiles with a slight roundness on the top make a natural recess or ditch for the grout fill as well as for dirt and accumulated wax. Some 1 × 1-inch tiles are also rounded and create the same difficulties. There are, however, flat 1 × 1-inch tiles and these are good. Any cleaning implement, from a hand sponge to an electric scrub brush machine, will make contact at all points and leave the floor completely clean. Remember that liquids will be spilled occasionally. A floor of glazed ceramic tiles would become slippery and such tiles should be avoided.

Vinyl Tile

Vinyl tile is, for good reason, probably the type of flooring most commonly chosen. It is very resilient, so it is comfortable to stand on for several hours. It is attractive and sold in many colors and patterns, so it can easily be color coordinated with any room. The three basic types of vinyl flooring are no-waxing sheet vinyl, homogeneous vinyl tile, and vinyl-asbestos tile.

Vinyl flooring is intended for home use and if it is selected for a preparation room, it is very necessary to purchase tile rated to withstand a load limit in excess of 100 pounds per square inch. When using sheet vinyl, have the flooring cut; so it can extend several inches up the walls; this seals the seams where the wall and floor come together.

Asphalt Tile

Asphalt tile is made of resin asphalt compounds and asbestos fibers, it is very hard and brittle. Asbestos fibers are no longer used in these products. Of all tile floors, it is the least expensive per square foot. It is easy to install, too! However, it must be used on cement or on an exceptionally strong floor that will not "work" (move) at all. Asphalt tile becomes increasingly brittle with age and new tiles will not have the aged appearance of those around them, making repaired areas very visible. This type of floor needs to be well waxed to ensure long life in the preparation room.

Epoxy

Epoxy is usually used directly over a cement floor. A layer of epoxy is spread over the floor and then chips of color (supplied with the epoxy) are often sprinkled onto it. The epoxy flooring should be finished in a rough coat fashion to prevent slippage. When the epoxy sets, several coats of clear plastic are applied. The number of coats (and the quality of the particular brand chosen) determines the durability of the floor. Epoxy coverings can also be used over old tile, wood, and other types of floors, but preparation of the old surface must be extremely thorough. Finally, these preparations can also be used on all surfaces. Epoxy floors are seamless, so it is an easy surface to disinfect.

Paint

Paint, of course, is the least expensive floor covering of all. But it will not stand up under wear and it is especially susceptible to damage from chemicals, so spillage is a real problem. An oil-based enamel paint is recommended.

▶ WINDOWS, DOORS, CEILINGS, AND WALLS

Windows, doors, and ceilings all function to some degree to control sound, light (Fig. 4–3), and odors.

Windows

The first factor influencing the selection of a window is the location of the preparation room in the building. If the preparation room is built in the basement, there will probably be a need to augment the natural ventilation available with some system of forced air. Aside from the obvious odor problems, the natural summer dampness in most parts of the country is a problem in a basement. Windows can be an available source for fresh incoming air when mechanical exhaust systems are running.

Privacy must always be ensured in the preparation room. In a basement location, frosted glass is usually necessary. Wire reinforcement in the glass is often essential in city areas because of vandalism. Frosted jalousie windows afford privacy while permitting air flow and can be a good choice. The inverted awning-type window ensures privacy when the window is open.

There are other considerations in selecting windows for first and upper floors. Movements within the room should not be visible as silhouettes or shadows on the window. When work must be done at night, heavy drapes are suggested as well as rolling floor screens or folding screens. At street level, windows can be protected from view by shrubbery or a louvered fence. Use inside or outside the building of materials that substantially decrease the volume of air flow possible through the windows should be avoided. Access to fresh air is important.

One of the best sources of light if architecture permits is the glass block wall; however, additional windows then become necessary for ventilation. If the preparation room is located on the top floor and is wedged between other buildings, restricting light and air flow from regular windows, plastic dome skylights should be considered. This sort of window also allows full use of wall space. Ventilation is aided as warm air rises rapidly to the ceiling and through the skylight under most weather conditions.

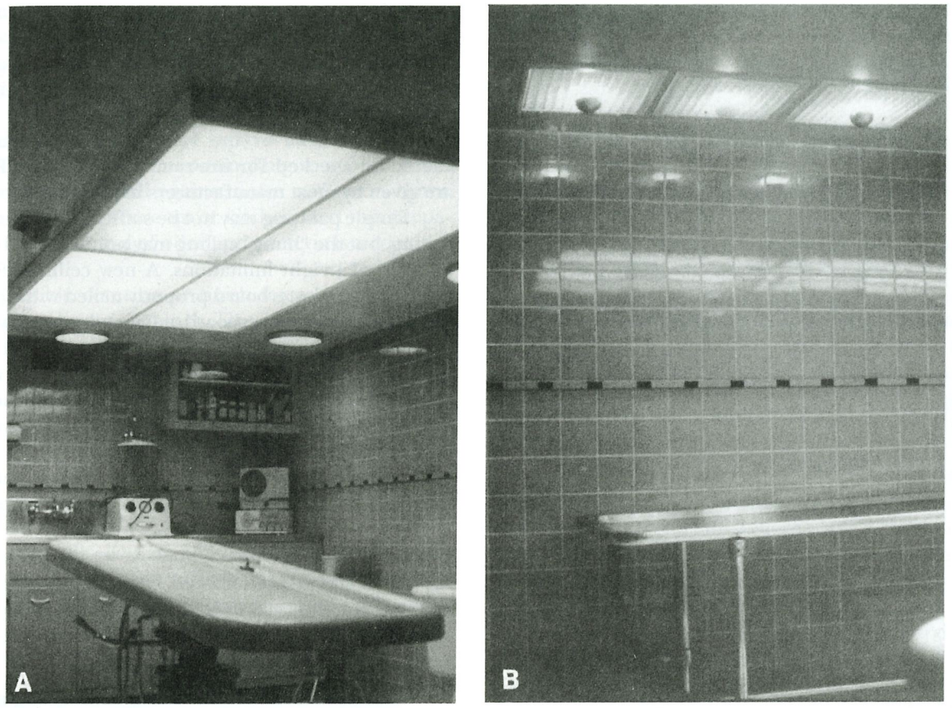


Figure 4–3. Preparation room lights. **A.** Adequate lighting. Note the number of electrical outlets available. **B.** Adjustable cosmetic lights.

Doors

Some state rules now require that preparation room doors be locked. This would be a good rule for all establishments to follow. Many funeral establishments use touchpad locking devices. This eliminates the need for keys, and the codes can be periodically changed.

Unless an architect is made aware that caskets will be taken through the door, she or he might well specify a conventional 30-inch door. **A 3-foot opening should be an absolute minimum. The narrower the corridor or passageway from which the room is to be entered, the wider the door should be to permit turning**. In addition to width, the direction in which the door opens is very significant. If a normal hung door might create problems, perhaps a "pocket" or recessed sliding door might be the answer. Should there be a structural reason that this is not practical, double-hinged doors folding to the right or left may be required.

The doors in the preparation room should be of high quality. Pre-hung doors are an excellent choice because they are of good quality and also save time in installation. To some extent, the size of the entrance and the area to which that entrance leads determine the type

of door needed. If the door leads to an adjoining garage, the insurance company or building code will probably call for a metal-covered door. In selection of an interior door, choices include doors with solid cores, hollow cores, solid fresco cores, solid wood staved cores, solid wood flake cores, or lead shield cores. All are available with different odor and sound control properties.

Advise the architect that all doors must be wide enough so that a stretcher or casket can easily pass through, and that the stretcher or casket may need to be turned at various angles to move it into or from a hallway or around some wall or other obstacle on one side of the door or the other. This warning has been previously mentioned but bears repeating. **Improper door size is one of the most common errors in preparation room planning**. The minimum width of the door should be at least 36 to 40 inches.

Ceilings

Ceilings can present a real problem, more so in renovation than in new construction, and, in particular, if the preparation room is in the basement. Frequently, the basement location means a low ceiling made lower by water pipes, heating ducts, and electrical lines. If consideration is being given to renovate such a ceiling to better insulate for sound, for the sake of appearance or for sanitation reasons, it must first be determined if there is sufficient height below the pipes, ducts, and electrical lines to construct a ceiling. If there is not enough height in the room or a room is being designed for a new building, be sure that at least 4 inches of sound insulation material is used, and the contractor allows complete and easy access to all pipes, valves, and electrical connections.

New "hung" or suspended ceilings can be an excellent choice if sufficient height is available. The large tiles provide easy access to everything above. Repainting or even replacing old ceiling tiles is a fairly inexpensive way to brighten up the room every few years.

Many suspended ceilings are available as complete systems, incorporating light fixtures and ventilation systems as well as the tile. Such systems, which disperse air through large areas of the ceiling, are especially suited to delivering large quantities of air at considerable temperature differentials with minimal draft and noise. Most of these systems require at least 15½ inches of hanging height.

Johns–Manville offers acoustical tile specially treated with antibacterial finish and bacteriostatic core. Tests have shown that the finish reduces bacterial population on the surface by 90% in 6 hours, and the bacteriostatic core does not support bacterial proliferation. For ceilings full of pipes or ducts, remember to clean the tops of these regularly with a good disinfectant.

Many funeral homes are created from old residences, and this usually means plaster ceilings. If the ceiling is in good condition, a coat of paint will make it look excellent again. If the plaster is at all loose, do not add ceiling material to it. Pull off the old ceiling, or at least all that is loose. Fur out the old base to align the new ceiling correctly.

The material of the various suspended ceilings should be checked for fire-retardant qualities. Ratings are given by most manufacturers in their data booklets.

Simple painting may not be sufficient to save an old ceiling, but the "hung" ceiling may not be a good choice because of height limitations. A new ceiling of three-eighths-inch plasterboard properly nailed with the new, better-gripping plasterboard nails and correctly taped can give years of service. Acrylic enamel paint would make it an easy ceiling to wash. **A white ceiling is a must. It gives the advantage of reflected light, and as accumulation of dirt is readily apparent on white, it is easy to make sure the ceiling is kept clean and sanitary**.

Another good ceiling material is one of the high-gloss finish hardboards. Marlite is a good example.

Walls

As with ceilings, walls should be selected with careful concern for the ease with which they can be kept sanitary (Fig. 4–4). Late in 1974, California enacted new

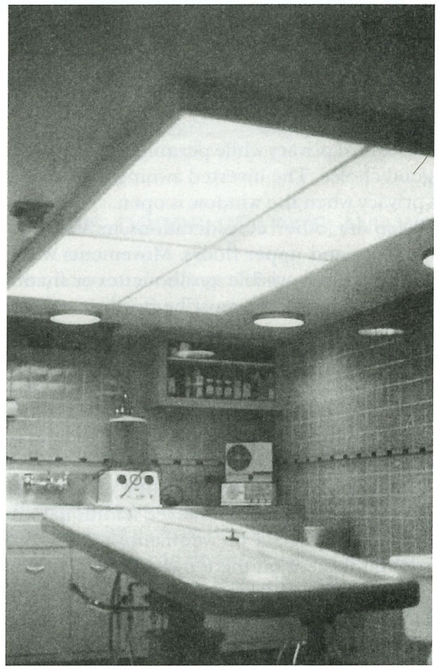


Figure 4–4. Walls tiled from the floor to the ceiling. The ceiling is soundproof.

regulations specifying sanitary requirements not only for preparation rooms but also for storage rooms (where bodies are held awaiting disposition). If a new wall is to be created, the material and method of construction are, in part, determined by the sort of room that will be on the other side. If that room is to be used by the public (as an arrangement or smoking room), then the wall must be insulated against noise and odor. Never plan an employee bedroom or kitchen next to a preparation room. Control of odor and bacteria is a constant worry.

A possible covering or finish for any wall of concrete is glazed masonry block. This comes in many sizes, styles, and colors and is easy to keep clean. The contractor must see to it that the mason keeps the grout joints smooth and close to flush with the tile surfaces for ease of cleaning. A poured concrete wall can be spray-painted after imperfections are plastered. Many plain and multicolored epoxy paints are available for use over any concrete surface. These surfaces should be finished with a clear glaze.

Modern adhesives make it possible to use ceramic tile on wallboard, which creates an excellent looking, durable wall. When dry wallboard is used by itself, it should be taped and surfaced carefully and sealed with good washable enamel. Plasterboard will absorb moisture, so it must be kept an inch or two from the floor and a cove base used. In a basement or damp area, set plasterboard considerably away from the outer wall. Acrylic and latex enamel paints will seal and protect plaster, drywall, and natural wood. It will also render them impervious to liquids, gases, and microbes.

Marlite wallboard is used extensively and is available in many colors with matching moldings. Marlite is one of the easiest walls to maintain, as are Formica surfaced cabinets. Reinforced fiberglass panels are available, which are a highly sanitary material. It is always good to make panels in this type of wall removable for easy access to wiring and other equipment located inside the wall.

Many choose to use tile of some sort only part of the way up the wall and paint or wallpaper above that. This is fine, provided that good, washable paint or paper is used. A flexible vinyl floor covering can also be used on a wall if there is a solid base surface to which it may be glued.

Sound Insulation

Sound insulation should not be overlooked. If the room is below, above, or adjacent to public areas the sounds of instruments dropping or machines in operation will certainly be unwelcome in those areas. Many companies make special-density cellulose fiber structural board that can be used in ceilings, walls, and floors to deaden sound. The use of such material in preparation room construction is highly recommended.

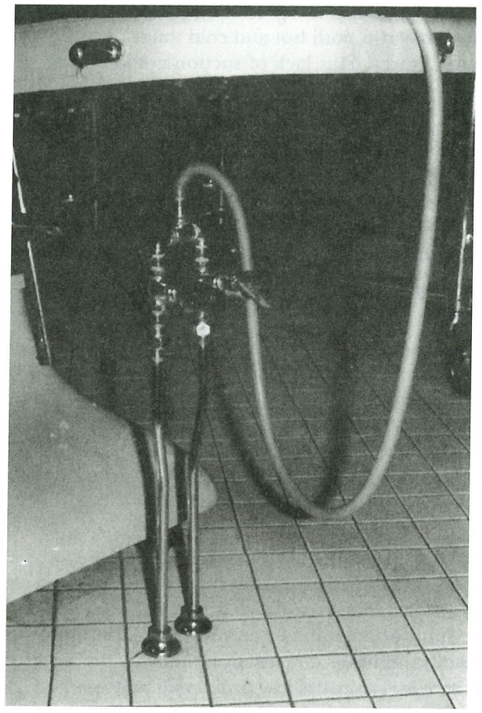


Figure 4–5. A floor water supply for the preparation table.

▶ PLUMBING

As with all facets of preparation room planning, to avoid later difficulties with plumbing, work closely with the architect and describe all the work that goes on in the area so that all fixtures, waste lines, and other equipment can be properly located. In case of blockages, all cleanout points in waste lines should be conveniently accessible (Fig. 4–5). Addition of a fixture not initially planned will probably not be easy.

Water pipe is like electrical service wire in that the larger the diameter of the pipe or wire, the more water or current will flow through it. Today, copper is usually used for water pipe because it does not easily corrode or rust. Another very convenient material to work with is polyvinyl chloride for both supply and drain. It is approved by many communities for residential use, but restrictions may be enforced for commercial applications.

The feed line after the water meter is normally three-fourth to 1 inch in diameter. The supply lines to the preparation room should be at least three-fourth inch in diameter. This size allows enough volume to operate waste sink flushometers properly and creates a good vacuum in a hydroaspirator. Some embalmers find

that the vacuum is not great enough in their aspirators unless they run both hot and cold water through a dual mixing faucet. This lack of suction could be the result of very small feed pipes or old, galvanized pipes.

> A good reason to have removable panels and ceiling tiles in strategic areas (so that access to plumbing and electrical wiring is convenient) is that of changing municipal codes. If there is a question of compliance with a plumbing code, it will be possible to make changes without ripping out the walls.

The second major plumbing consideration deals with codes. Having discussed bringing in an adequate water supply, the subject of disposal of waste water must be considered. How wastes are handled is a major concern. Codes and regulations change as knowledge of good sanitation procedures increases.

Backflow

Backflow is the unwanted reverse flow of liquids in a piping system. It can be caused by back-siphonage, backpressure, or a combination of both. Back-siphonage is due to a vacuum or partial vacuum in the water supply system. It is caused by **ordinary gravity**—when water supply is lost and a fixture that is elevated is opened, allowing air into the system, water will (by gravity) reverse flow; **undersized piping**—high-velocity water traveling through undersized piping can cause an aspirator effect and draw water out of branch pipes causing a partial vacuum and a reverse flow; and **vacuum**—pumping water from the supply system creates a pressure drop or a negative pressure in the system, or a break in the main or excessive usage at a lower level in the system can also be a cause.

Many water departments now require a backflow prevention (one-way) valve at the point at which the water enters the funeral home from the street. The installation of these devices is favored where the water enters the preparation room (not just the funeral home) on both hot and cold lines. In this way, the public within the funeral home, as well as the community, are protected from accidentally contaminated water.

In the early 1970, the state of Connecticut started a program requiring the use of back-flow prevention devices. Since then, additions to these regulations now require special faucets to be used with hydroaspirators, which must be equipped with vacuum breakers. These faucets are made for industrial use as in commercial laundries. The fixture is dull in finish and has a vacuum breaker built into the top of the spout.

Electric Aspirator. The trocar is attached via the hose on the right side of the impeller casing. The hose coming off the left side leads directly to the top of the flush sink. The small tube of the top of the impeller casing draws water from the bulb that is attached to the water faucet. The water faucet attachment has two water supplies—one to the bulb to keep the impeller lubricated when no aspirant is flowing through the trocar, and one of the opposite side (with an attached hose) for water to be supplied for other purposes. The impeller casing has three screws that allow for removal of the impeller for replacement or drying (Fig. 4–6A).

Hydroaspirator with Vacuum Breakers. The hydroaspirator is attached to a water faucet over a flush sink. A

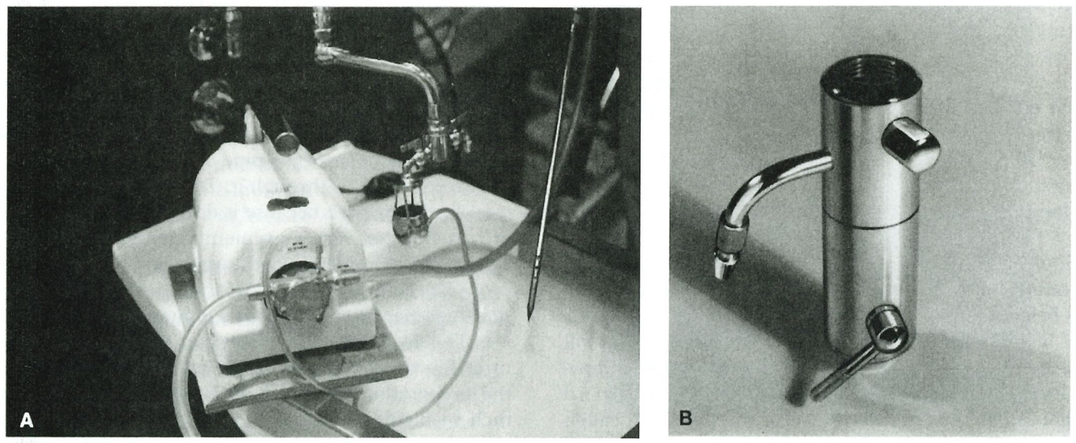


Figure 4–6. A. Electric aspirator. **B.** Hydroaspirator.

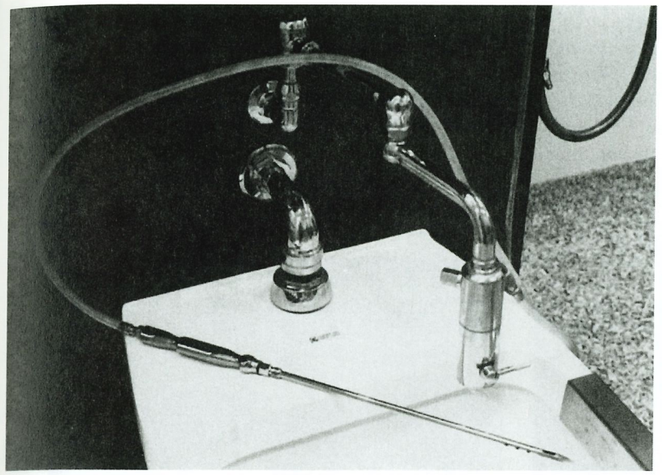


Figure 4–7. Vacuum breakers.

clear plastic hose connects the aspirator and trocar. The level near the bottom of the aspirator allows for clean water flow from the hose or for aspiration (suction) if the lever is vertically aligned with the aspirator (Figs. 4–6B; 4–7; 4–8; 4–9).

One consideration is to put vacuum breakers into the hot and cold supply lines for the preparation room rather than on each faucet. A siphon-breaking device or backflow preventer is a rather simple mechanism that is attached to a threaded faucet before the hydroaspirator is mounted. It combines a check valve and air vents. When water forces open the check valve, the air vents are automatically closed. If water pressure drops, the check valve closes automatically and the air vents are opened, preventing any backflow into the supply line. The air vents break any built-up vacuum. This inexpensive but effective device is available through most preparation room suppliers.

Backflow and siphonage are very real hazards in funeral homes, especially if the volume and pressure of the water entering the building are not great enough to adequately supply all outlets in the building. For example, if the pressure is barely adequate for aspiration, flushing a toilet or starting a washing machine can cause such a drop in pressure at the aspirator faucet that a vacuum results, drawing waste materials into the waterline.

Because of the serious nature of backflow problems, OSHA has addressed the problem nationally.

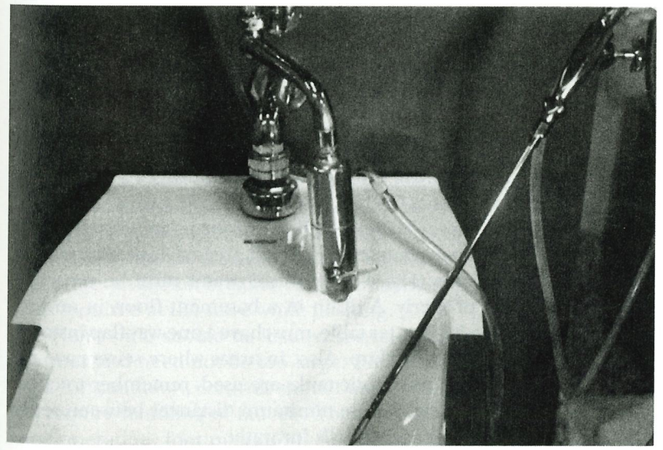


Figure 4–8. Hydroaspiration in a visible position.

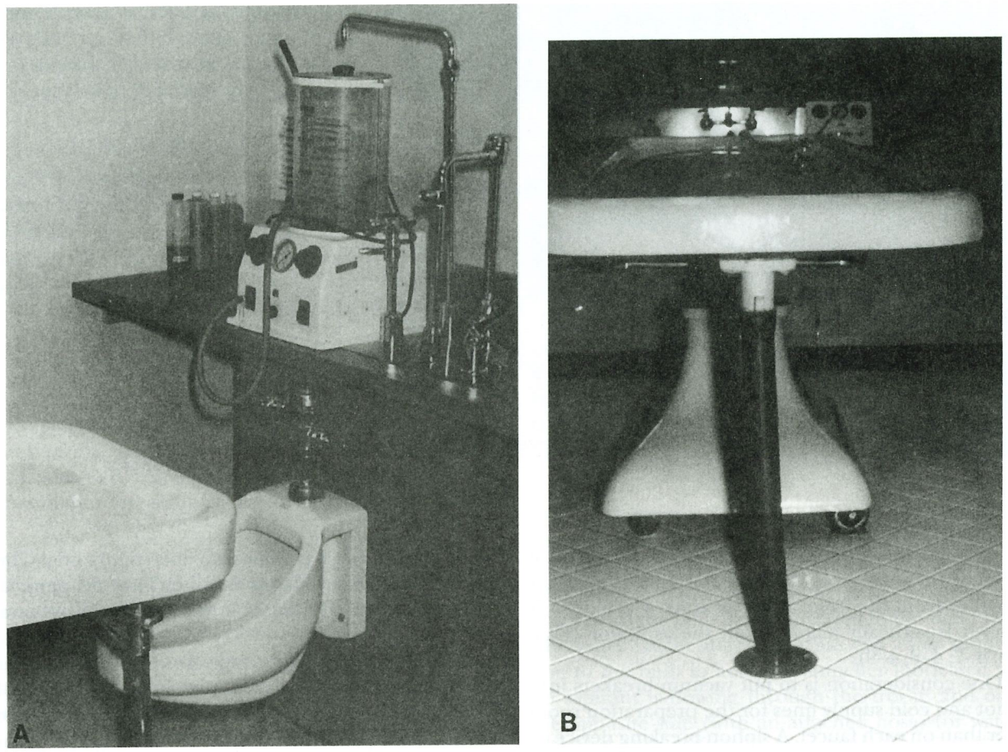


Figure 4–9. A. Flush drain. **B.** Floor drain.

Subpart J of the Occupational Safety and Health Act pertains to general environmental controls. Paragraph 1910.141(b)(2)(ii) contains the following statement: "Construction of nonpotable water systems carrying any other nonpotable substance shall be such as to prevent backflow or back siphonage into a potable water system.*

In discussing placement of hydroaspirators, it is important to remember that the aspirator should not be attached to a faucet in a sink in such a way that it is below the top of the sink walls (Fig. 4–8). This means that the operator cannot see the aspirator. The aspirator, therefore, should be at least 2 inches above the rim of the sink. Large, clear, plastic tubing can be attached to the aspirator so the embalmer can see the materials being aspirated, this will also help to avoid splashing. Another problem with hydroaspirators can occur during aspiration of tissue particles. These can become lodged in the aspirator throat and block it, causing the operator to inject water into the body via the trocar.

*This revision was published in **Federal Register.** 1973;38:10930.

Drains

No discussion of preparation room plumbing would be complete without a discussion of drains. In planning the location of drains, remember that the drain pipe must have a downward slope of one-fourth-inch over every foot of length from point of entry into the room to the point of exit. Commercial sealed sump pumps can be installed to lift wastes. Also, where codes allow, flush-up toilets may be used (Fig. 4–9A). Such toilets need a minimum of 40-pounds psi of pressure sustained at 4 gallons per minute for a 10-foot lift.

A central floor drain surrounded by a slope is inconvenient. Church trucks and cots can wobble, roll, and cause damage. A floor drain in an out-of-the-way corner surrounded by a small area of slope avoids these problems (Fig. 4–9B). Waste drains must be vented to flow properly. A drain in a basement floor, in an area with a high water table, must have a one-way flap installed to prevent backup. Also, in areas where sewers are not available and septic tanks are used, remember to check codes to determine minimum distances between septic tank systems and wells for water.

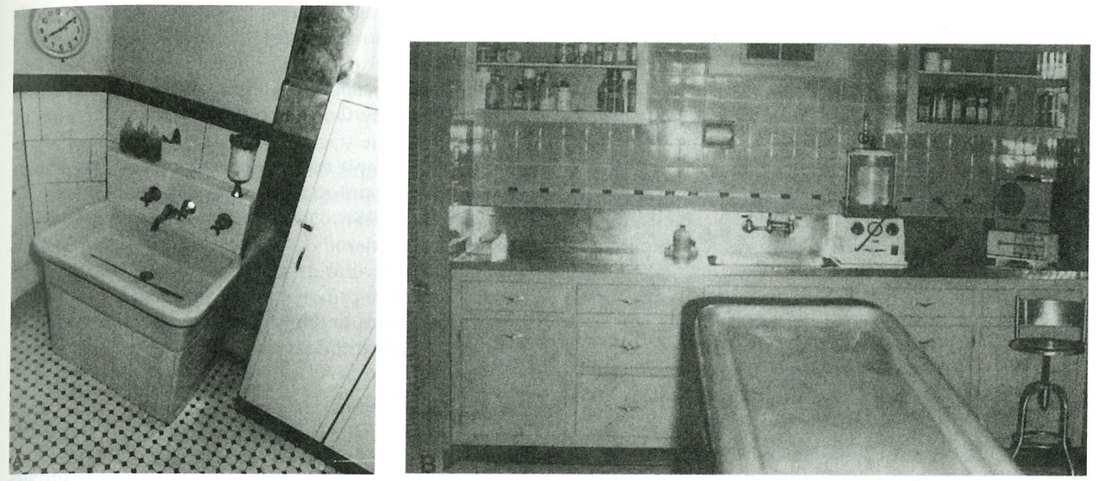


Figure 4–10. A. Wide porcelain utility sink. **B.** Stainless steel utility sink.

Water Supply

Most codes require hot as well as cold water in the preparation room. Certain states even set a minimum temperature requirement of 130°F or 145°F. OSHA requires that all steam and hot water pipes be insulated when it is possible for an employee to come in contact with the pipes. It is not always convenient to insulate. One possible alternative for pipes leading to freestanding sinks is to enclose them in a cabinet.

Convenient water service to the embalming table, the embalming machine, and the sinks can save much time and many steps. The table is the work center. Water can be fed to it either from an overhead supply or directly from service sinks. If the table is permanently located, a supply line can be placed under the head area, coming up from the floor or dropping from the ceiling. The overhead service is really handy for washing the remains and shampooing and rinsing the hair.

Sinks

There are many alternatives from which to choose in selecting a waste sink for the embalming table (Figs. 4–8 and 4–9A). A sink that permits good floor maintenance should be selected. Flushable sinks, whether floor standing or wall-hung, are the most sanitary. The flush valve incorporates a vacuum breaker. A minimum of 20-pounds psi is required at the valve while flushing.

Hand sinks should be located conveniently for the operator and need not be too large. Remembering the need for sanitation, controls should be selected that do not require handling of faucets. There are controls for knee operation, foot operation, and elbow or forearm operation. A gooseneck faucet facilitates the filling of large bottles and pails (Fig. 4–10A).

Sinks can have surfaces of china, enamel on pressed steel, or stainless steel. Stainless steel is popular but harder to keep clean looking. A bottle or instrument dropped in a stainless sink makes an awful racket! Flush-surface hand sinks in countertops are even easier to maintain than wall-mounted ones. If plans call for a separate dressing room, the cosmetician and hair-dresser should have their own sink.

▶ VENTILATION

No discussion of the embalming environment is complete without a thorough and cautionary discourse on the subject of ventilation and the necessity to protect the embalmer. Adequate ventilation is essential. A preparation room should have 12 to 20 air exchanges per hour; 15 changes are recommended.

Formaldehyde

Formaldehyde is irritating to work with, for this reason alone proper ventilation is absolutely necessary.

Formaldehyde gas may cause severe irritation to the mucous membrane of the respiratory tract and eyes. Morrill reported sensory irritation (itching of eyes, dry and sore throat, increased thirst, and disturbed sleep) in paper-process workers at 0.9 to 1.6 ppm formaldehyde. Bourne and Seferian reported from another occupational setting intense irritation of eyes, nose, and throat at levels ranging from 0.13 to 0.45 ppm. More

recent studies by Kerfoot and Mooney and Moore and Ogrodnik* conducted in funeral homes indicate that concentrations from 0.25 to 1.39 ppm evoke numerous complaints of upper respiratory tract and eye irritation and headache among embalmers. Schoenber and Mitchell report that acute exposure to formaldehyde phenolic resin vapors at levels around 0.4 to 0.8 ppm causes lacrimation and irritation of the upper as well as the lower respiratory tract. The levels at which serious inflammation of the bronchi and lower respiratory tract would occur in humans are unknown; inhalation of high levels, however, has caused chemical pneumonitis, pulmonary edema, and death.

Emerging technology and thought in the design and construction of preparation rooms reflect the recognition that **because formaldehyde is heavier than air, exhaust systems located at or near floor level, when combined with the introduction of uncontaminated air from the ceiling level, are an efficient method of ventilation**. In addition, such systems have the added advantage of drawing fumes and contaminants down and away from the operator's face during the embalming procedure. **The key to the creation of an embalming environment protective of the embalmer's health and comfort is air flow and adequacy of ventilation**.

The number and location of windows and doors are obviously components of the total ventilation system. Cross-ventilation (which requires windows on opposite walls) is highly desirable and should be designed into every preparation room if at all possible.

If there is sufficient height in the room to install a hung ceiling, install one that will dispense air through large areas in the ceilings. These have the ability to deliver large quantities of air at considerable temperature differentials with minimal draft and noise.

Many preparation rooms are equipped with the familiar kitchen exhaust hood. When it is installed over the waste sink at a height of about 4 feet, air is drawn out slightly above table level. Because the hood is located over the waste sink, unpleasant odors are kept away from the operator. **In choosing the location of the exhaust, care should always be taken so that air flows away from the operator**. Calculations should also be obtained from a ventilation engineer to determine the number of room air changes per hour created by the system.

The grill on the exhaust fan, and on all other grills in the room, should be easily removable for cleaning. Grills are often loaded with dust "kitties," and this environment is a perfect site for proliferation of bacteria. Be careful when planning an exhaust vent that goes directly from the preparation room to the roof. The architect may not realize that such a vent, located too near a roof-mounted air conditioner, could cause foul odors and pathogens to return through the air conditioner's intake vent.

Basement preparation rooms are the toughest to ventilate properly. One major problem in some areas of the country is the stagnant, humid air that can make a basement very unpleasant during the summer. Mold can start developing unless a dehumidifier is installed.

The possibility of drafts creating dehydration should be considered carefully in laying out the preparation room. Several new preparation rooms have required expensive redesign and reinstallation of ventilation systems because the first few cases embalmed were so seriously dehydrated by drafts.

Air Conditioning

Although there are many different air conditioning units to choose from, the size of the room in cubic feet and the desired number of room air changes per hour determine the size of the unit needed. If the entire funeral home is air conditioned by the same unit, there must be independent controls for the preparation room. Odors must not reach the main air flow serving the funeral home. Many times, a separate preparation room "zone," controlled manually, is recommended.

The wall or window unit is also adaptable for cooling the preparation room. Such units pull in cool fresh air from outdoors. If properly balanced with the exhaust system, a "once through" ventilation system can be created and used during the embalming operation.

▶ PREPARATION ROOM EQUIPMENT

Refrigeration units since the mid-1970s, when the Federal FTC Rule required permission for embalming, there has been a rise in the number of funeral facilities having refrigeration units. These can range in size from a unit holding two bodies to a walk-in room which can hold 50 or more deceased human remains. The purpose of these cooling units is to slow the postmortem changes in the deceased body in particular decomposition.

Refrigeration temperature ranges from 35°F to 45°F. The State Board of Pennsylvania mandates that the temperature must be maintained between 35°F and 40°F.

The cooling unit should be locked by key or touch pad. A log should be kept with the following information: name of deceased, date, time, and employee who placed the deceased into or removed the deceased from the cooler. For large coolers, this log should include the location of the deceased within the cooler. A cleaning schedule needs to be maintained for the cooler and any spills of biohazard liquids needs to be immediately cleaned. Floors and body trays must be frequently

*See Selected Readings for complete Kerfoot and Mooney Study and Moore and Ogrodnik studies.

disinfected and washed. Bio-hazard bins within or outside the cooler will provide a place for disposal of soiled laundry or soiled cleanup materials. For walk-in coolers, a composite floor with floor drains is necessary. Sufficient lighting should be provided within the cooling unit.

All decedents placed into the cooler need to have an identification attached to the body and the body bag. Human remains need to be positioned in a supine position with shoulders and head elevated. They should be within a body bag or covered with sheeting. Unembalmed bodies should be sprayed with a topical disinfectant, any purge material removed from the face and neck and a light coating of massage cream placed on the face and neck before being placed into the cooler.

Body Lifts

Lifting devices are essential. Their use can include movement of the deceased from the removal cot to the embalming table; removal from the embalming table to a dressing table or placement within a casket; removal of shipped-in remains from the shipping container to the dressing table; placement of decedent into a shipping container. As much lifting as possible should be done by mechanical devices.

Body Transfer Board

These thin, smooth, flat polyethylene boards, are strong, non-absorbent, and easily cleaned. Placed under the body, they can be used to move the body from the removal cot to other tables in the preparation room for embalming or refrigeration storage. They can also be used to move bodies between embalming tables to dressing or storage tables.

Tables

Embalming tables are available with stainless-steel, porcelain or stain-resistant fiberglass tops and cast iron, steel, or aluminum bases. These bases may have a hydraulic or ratchet-type raising, lowering, or tilting mechanism. They all have a drain channel around each side, with a drain hole at the foot end. Most stainless-steel tables have wheels, whereas the older porcelain tables have a swivel-action base (Fig. 4–11). "Body bridges" can be used with the stainless-steel and fiberglass tables; they elevate the body above the table making the entire table a drain channel. Thus, drainage is easily flushed away from the body and the embalmer.

At the completion of the embalming, the body may be transferred from the embalming table to a dressing table. Dressing tables usually have a laminated plastic top and an aluminum frame. The frame has wheels, is adjustable in height, and perhaps can fold in the middle. There is no drain channel or hole in a dressing table as in the embalming table.

Injection Apparatus

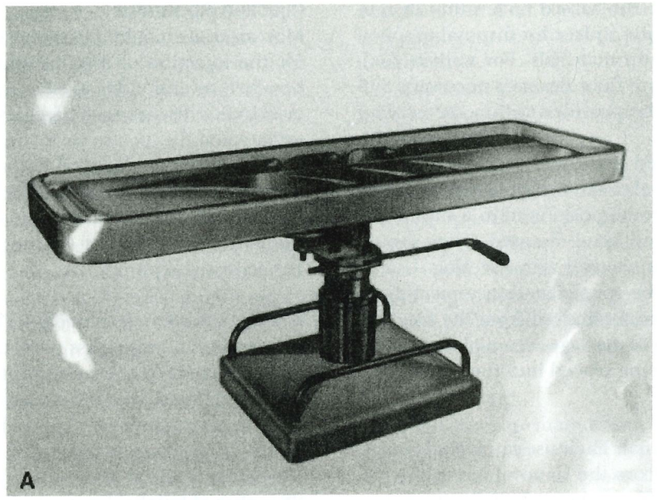
Most arterial embalming is done using electric machines for the injection of arterial solution. To be complete, however, several older mechanical methods are considered in this discussion. These devices are generally used today when the electronic machines are not working or when there is an electrical failure. Basically, six devices can be used to inject arterial solution: (1) gravity; (2) bulb syringe; (3) combination of gravity and bulb syringe; (4) hand pump; (5) air pressure machine; and (6) centrifugal pump.

Gravity Injection (Historical). The arterial solution is poured into a large glass percolator that has a delivery hose attached to the bottom of the bowl. The device is then elevated above the body and the solution flows into the arterial system. Approximately, one-half (0.43) pound of pressure is developed for each foot of height the device is raised above the injection point (for every 28 inches of height, 1 pound of pressure is created). Because of height restrictions in most preparation rooms, pressure is limited with gravity injection. This method of injection is still widely used for injection of bodies that will be used for anatomical dissection. Gravity embalming provides a slow, steady method of injection that allows the body to accept the embalming solution at a slower rate allowing more of the arterial solution to be retained by the body tissues (Fig. 4–12).

Bulb Syringe (Historical). This hand-held and hand-operated device consists of a rubber bulb with hoses attached to either end. A one-way valve in the device allows for this pump to operate. One hose is dropped into a container of embalming solution. Arterial solution flows into the bulb when the device is relaxed. Once the bulb is full, squeezing the bulb forces the arterial solution into the delivery hose and into the body. It is important to remember that the solution actually passes through the bulb syringe. Pressures are unknown and it does require the use of one hand. As pressure builds within the body, the bulb syringe becomes more difficult to squeeze (Fig. 4–13).

Combination Gravity and Bulb Syringe (Historical). In this method of injection, the delivery hose from the gravity percolator connects to the bulb syringe. The body can be embalmed by the gravity method, but pressures and rate of flow can be increased periodically by squeezing on the bulb syringe. The combination produces a greater pressure and rate of flow of the arterial solution.

Hand Pump (Historical). This hand-held device is a pump with two slip-hubs to which hoses can be attached. One hub delivers air to create pressure; the other hub creates a vacuum. Arterial solution does **not** flow



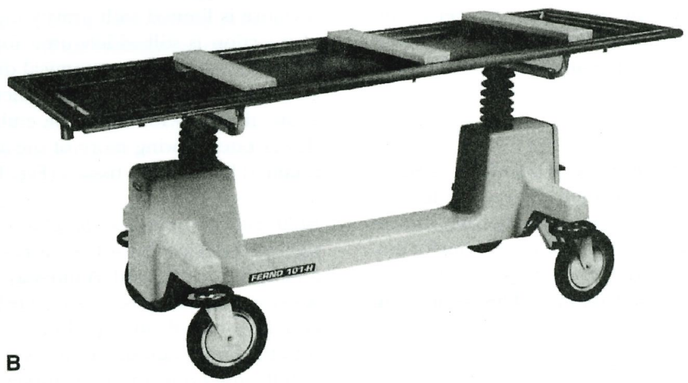


Figure 4–11. A. Hydraulic, porcelain preparation table. Note the elevated central portion and ribs to drain fluids away from the body. **B.** Hydraulic, stainless steel embalming table shown with body "bridges." (**Courtesy of Ferno-Washington, Inc., Wilmington, Ohio**.)

through the hand pump. The arterial solution is placed in a jar and the lid is sealed into position. Air pumped by the hand pump enters through the hose leading from the hand pump to the jar. A delivery hose, which drops to the bottom of the jar, then carries the solution out of the jar and into the body. A careful check is necessary to be certain that air is not injected into the body if all the arterial solution is injected. By attaching the air hose to the other hub of the hand pump, air can be withdrawn from the jar and; thus, a vacuum created within the jar. A trocar can be attached to the free end of a hose which is attached by a gooseneck inserted into the jar lid. The aspirated contents will flow into the jar. No aspirated material passes through the handpump.

Air Pressure Machine (Historical). The air pressure machine (Fig. 4–14) operates just like the hand pump, but because it is motorized, it relieves the embalmer from having to physically operate the device. The air pressure machine, like the hand pump, can be adapted to aspiration. Embalming solution and aspirated materials **do not** flow through the machine. The machine provides only air pressure or a vacuum. The delivery hose from the machine is attached to a reinforced plastic jar or metal pressure tank. The jar is the source of arterial solution, and also it will be the container into which aspirated materials will collect. This device can be very dangerous and pressures must be carefully observed. Some will produce pressures and vacuum up to 30 psi. This method

Figure 4–12. Gravity injector.

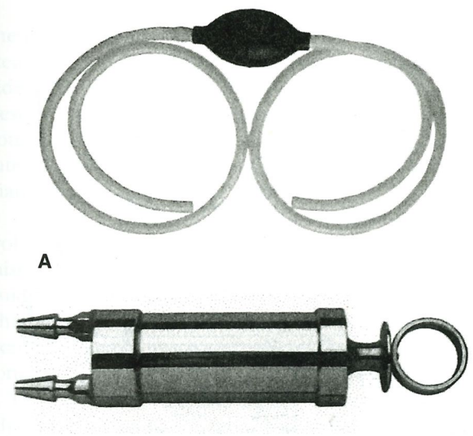


Figure 4–13. A. Bulb syringe—injection only. **B.** Hand pump—injection or aspiration.

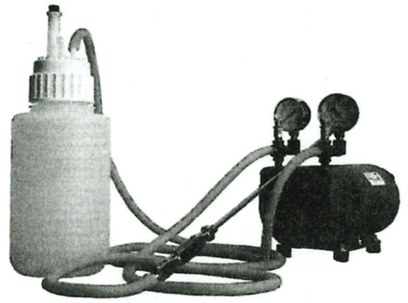


Figure 4–14. Air pressure machines may be used for injection or aspiration.

of injection is still widely used in Great Britain and Europe.

Centrifugal Pump. Because the centrifugal pump is the most widely accepted method of injecting arterial solution today, a more extensive explanation is given for this mechanical pump (Fig. 4–15). The centrifugal pump embalming machine is a self-contained device. Over the years, a wide variety of machines, each with special features, have been available. Some even contain a separate system similar to an air pressure machine for aspiration. Most of these machines have large-volume tanks, a few of which hold as much as $3\frac{1}{2}$ gallons of solution. With the motorized force pump, a constant preset pressure can be maintained in addition to the preset rate of flow of arterial solution into the body. It is always recommended that pressure be adjusted prior to arterial injection. The rate of flow can be determined once the arterial injection begins.

During the embalming, it may become necessary to reset pressure and rate of flow to establish a good distribution of the embalming solution. The pressure ranges in the motorized force pump can be very great. Some machines are capable of producing up to 200 pounds of pressure. In some machines, the motorized centrifugal pump runs at a constant speed. In others, the speed can be varied, and in yet other machines, two separate motors operating at different speeds are available. Many of these machines can produce a pulsating injection of fluid into the body.

Several terms must be explained at this point.**Pressure** is the force required to distribute the embalming solution throughout the body. The **rate of flow** is the amount of embalming solution that enters the body in a given period and is measured in ounces per minute. **Potential pressure** is the pressure reading on the gauge in the centrifugal machine, indicating the pressure in the delivery line of the machine with the rate-of-flow valve closed or the arterial tubing clamped shut.

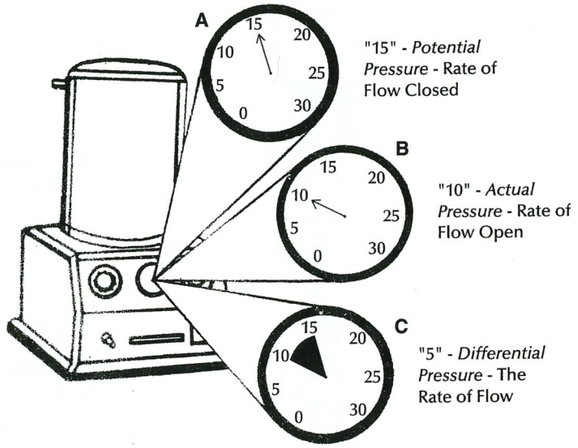


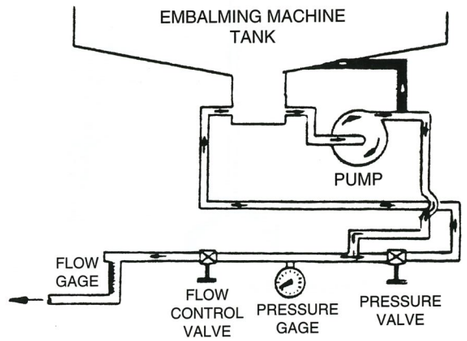
Figure 4–15. Centrifugal pump. **A.** Potential pressure (15), rate of flow closed. **B.** Actual pressure (10) rate of flow open. **C.** Differential pressure (5) or rate of flow.

Differential pressure is the difference between the potential pressure reading and the actual pressure reading; this is an indicator of the **rate of flow. Actual pressure** is the reading on the pressure gauge on the centrifugal pump when the rate-of-flow valve is open and the arterial solution is entering the body.

In the example described in Figure 4–15, with the rate-of-flow valve **closed,** the potential pressure is 15-pounds psi. The differential pressure is 5 and the actual pressure when the rate of flow valve is open is 10. If it were open until the gauge dropped to 5 actual pounds, the differential would be 10, or it can be said that the rate of flow would be twice as fast as the previous setting. The differential reading indicates the amount of resistance in the body, in the arterial cannula, and in the tube running from the machine to the cannula. The differential is also an important indicator of the rate of flow. Flow rate gauges may also be added to the centrifugal machine.

There has been much misunderstanding in regard to the pressure that may exist inside the body as a result of the injection of solution. The mere fact that a pressure gauge reading on the device used for injection indicates a given pressure at which the fluid is leaving the machine does not necessarily mean that this pressure exists within the body. To determine what the pressure reading on the gauge really means, take a look at the schematic diagrams (Figs. 4–16 and 4–17) showing the internal structure of an embalming machine, with four different flow paths shown as "filled" tubes (solid black) numbered from 1 to 4.

Liquid flows from the "well" beneath the tank to the pump from which it follows either path 1 or 2 or both paths (Fig. 4–16). Path 1 represents the bypass flow from



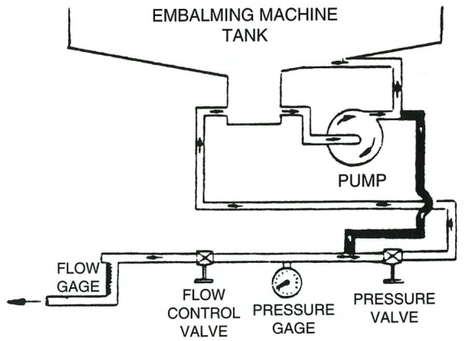
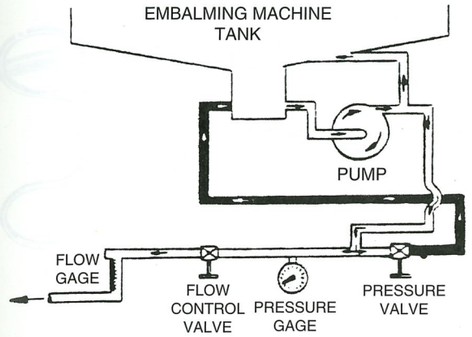


Figure 4–16. Pressure paths 1 and 2.



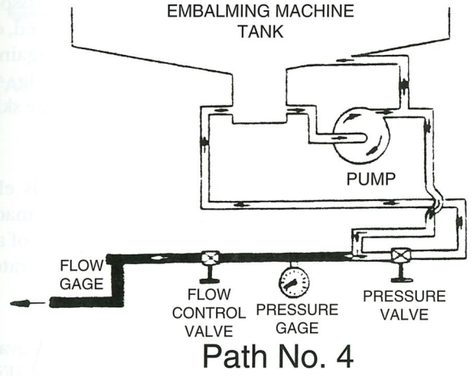


Figure 4–17. Pressure paths 3 and 4.

the pump back to the tank. As the pump functions at a steady and continuous capacity, it is necessary to provide such bypass when injection of fluid at a slow rate is desired. Otherwise, the full force of the pump pressure could not be controlled to permit such low injection rates. Path 2 is the flow from the pump to the intermediate line just prior to the outlet line.

The intermediate line contains the rate-of-flow control valve and the pressure control valve. As may be surmised, the pressure control valve determines how much fluid will be returned to the tank via path 3 (Fig. 4–17), which constitutes a second bypass in the system. If, for example, a maximum pressure is set at the pressure valve control, very little, if any, liquid will flow through path 3. The needle valve in the pressure control valve actually cuts off fluid flow to that bypass and so the fluid is forced, then, to flow on to the outlet.

As the fluid proceeds to the outlet, the rate-of-flow control valve will determine how much will be delivered

Figure 4–18. Centrifugal embalming machine. These machines are available with or without pulsation.

to the arterial tube outlet indicated by path 4. When pressure, as regulated by the rate-of-flow control valve, is drastically reduced so that only a small trickle of fluid is delivered, then high pressures can readily be registered on the pressure gauge. This does not mean, as can be readily realized, that the fluid is leaving the arterial tube under **that** much pressure!

In other words, with liquid flow paths 3 and 4 cut off by reducing the rate of flow and cutting off the bypass of fluid beyond the pressure control valve (causing high pressures to be registered), fluid can then leave the pump in large quantities only through path 1, which is the bypass back to the tank. It should be remembered that regardless of the amount of pressure being used or how fast the rate of flow might be, the pump **always** operates at the same speed and its output is **always** the same. With this knowledge in mind, safety features in the nature of the bypass are included in pressure machines. The pressure reading on the gauge merely indicates the amount of resistance being offered to the flow of the liquid **within** the confines of the machine. Continual use of "high" pressure places a heavy load on the motor and pump and, most often, this is not necessary (Fig. 4–18).

▶ INSTRUMENTATION

An embalming chemical supply catalog lists many instruments, most of which come in a variety of sizes and modifications. Actually, very few instruments are needed in the preparation of the unautopsied or autopsied body. Most instruments have several uses and this helps to limit the number needed. Unlike a surgical procedure,

Figure 4–19. Aneurysm needle.

embalming is not performed under sterile conditions, so instruments can be reused during the embalming process. Most instruments are constructed of steel and plated with nickel or chrome for protection against rust or chemical agents. They are chemically treated to be heat resistant and durable.

General Instruments

Aneurysm Needle. A blunt instrument (Fig. 4–19), the aneurysm needle, is used for tissue dissection for determining the location and elevation of arteries and veins. The aneurysm needle has an "eye" in the hook portion of the instrument, which could be used for passing ligatures around a vessel. An **aneurysm hook** is similar but has a sharp pointed tip. Most embalmers prefer to work with the blunt instrument.

Bistoury Knife. The bistoury knife is a curved cutting instrument that cuts from the inside outward (Fig. 4–20). Some embalmers prefer this type of instrument for opening arteries and veins. It can also be used for the excision of tissues.

Hemostat (Locking Forceps). A wide variety of hemostats are available. The hemostat can be used to clamp leaking vessels. A modification is the **arterial hemostat**, which is used to hold the arterial tube in an artery. The ends of hemostats may be curved or straight, serrated or smooth, or plain or rat-toothed. **Dressing forceps** are very long hemostats. They can be used for packing orifices or handling contaminated bandage dressings (Figs. 4–21 to 4–23).

Scalpel. The scalpel is a sharp cutting instrument used for making incisions (Fig. 4–24). It can be purchased with a permanent blade, or the handles can be purchased and disposable blades used. OSHA regulations requires a **sharps container** for the disposition of scalpel and razor blades, These puncture proof containers come in a variety of sizes.

Figure 4–20. Bistoury knife.

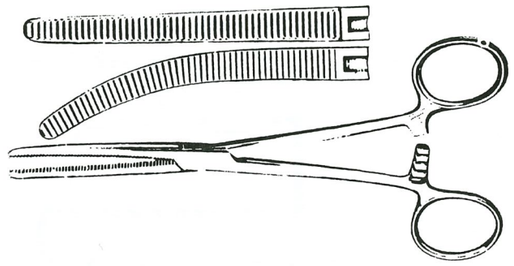


Figure 4–21. Serrated edges.

Scissors. Scissors are used for cutting. Like the bistoury knife and scalpel, scissors can also be used to open arteries and veins (Fig. 4–25). There is an **arterial scissors** (Fig. 4–25D) manufactured for opening vessels. Scissors vary in length, and their tips may be straight or curved, or pointed or blunt. The blunt side should be used against the skin surface of the body. **Bandage scissors** (Fig. 4–25E) have a very large blunt end to help protect the skin from being cut.

Separator. The separator is used to keep vessels elevated above the incision. This instrument can be made of hard rubber, bone, or metal. Often, the handle of an aneurysm needle is designed to function as a separator (Fig. 4–26).

Suture Needles. A variety of suture needles are available (Fig. 4–27). The large **postmortem needles** (Fig. 4–27A,B) are used to close autopsy incisions as well as incisions made to raise vessels for injection. These needles are half or double curved. The three-eighth-inch **circle needle** is used for more delicate suturing. The needle eye may be the patented type called a "spring eye" for "self"-threading. The edges can be smooth or cutting (Fig. 4–27C). The half-curved **Loopuypt needle** (Fig. 4–27E) is designed to better grip the instrument.

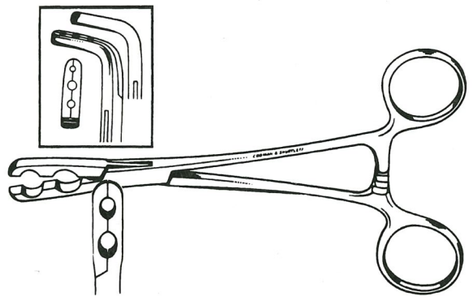


Figure 4–22. Arterial hemostat.

Figure 4–23. Dressing forceps.

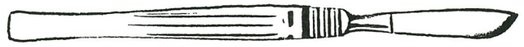
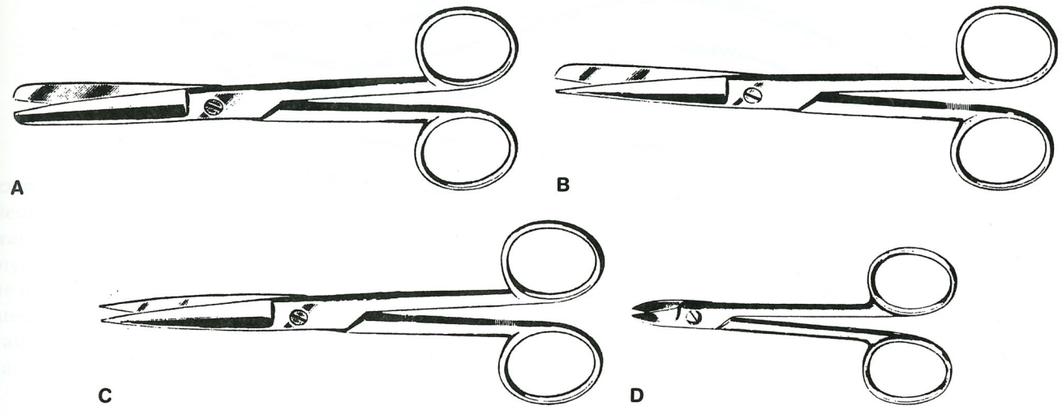


Figure 4–24. Scalpel.



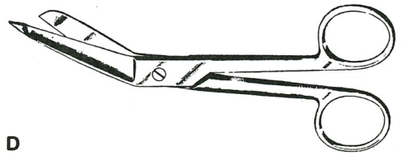


Figure 4–25. A–E. Various types of scissors.

Figure 4–26. Separator.

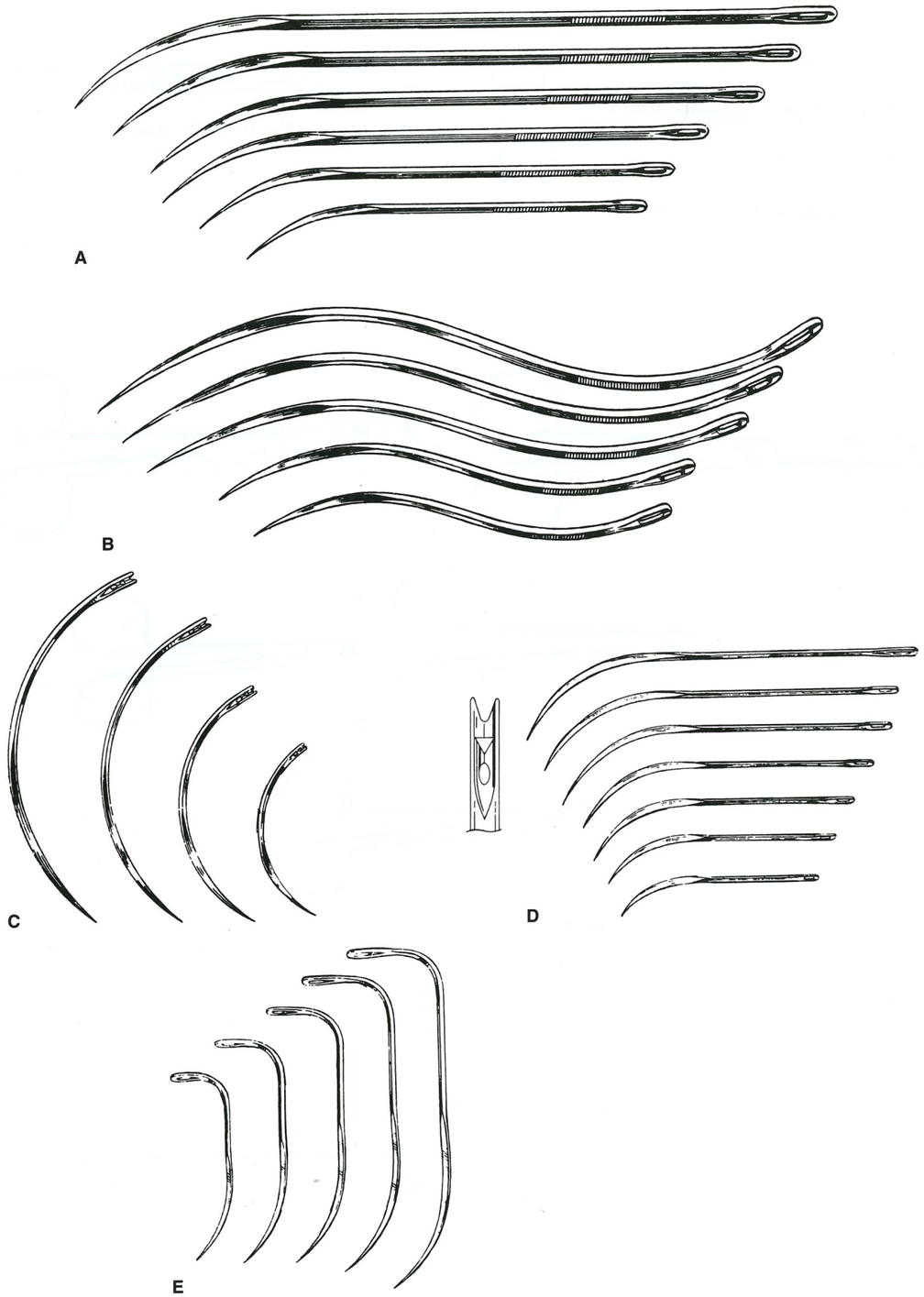


Figure 4–27. Miscellaneous types of suture needles. **A.** Postmortem half-curved suture needles. **B.** Postmortem double-curved suture needles. **C.** Three-eighths-inch circle needles with "spring eye." **D.** Half-curved suture needles. **E.** Loopuypt needles.

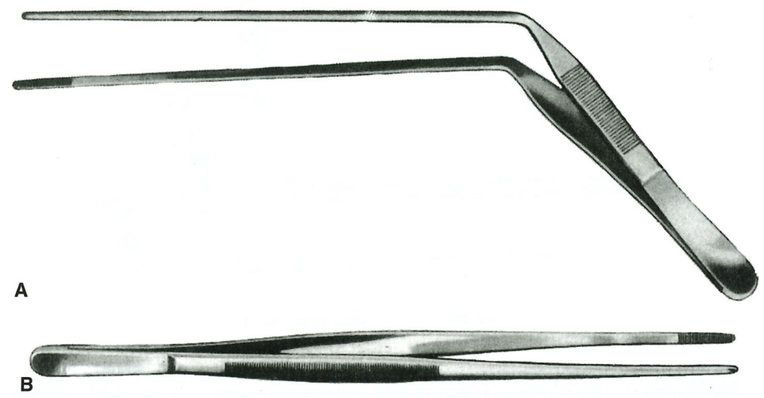


Figure 4–28. Forceps. **A.** Angular springs. **B.** Straight spring.

Spring Forceps. The spring forceps is an instrument used for grasping and holding tissues. The limbs may be straight, curved, or angular (Fig. 4–28). Angular spring forceps are used as a drainage instrument, generally in the internal jugular vein. The tips of forceps may be serrated, smooth, or rat-toothed. Most embalmers use several types and lengths of spring forceps. This instrument is available in a large variety of lengths.

Suture Thread. Suture thread is sold by the twist or cord, three cord being thinner than five or seven cord. Suture thread is available in nylon, cotton, and linen. Some embalmers prefer that it be waxed. Dental floss can also be used for suturing.

Injection Instruments

Arterial Tubes. There are many types, lengths, and sizes of arterial injection tubes: those small enough for injection of infants and distal arteries, such as the radial and ulnar arteries in the adult, and those large enough for injection of the large carotid arteries. Carotid tubes are short and very large in diameter. The hub of an arterial tube can be a **threaded** type (Fig. 4–29A), to which a stopcock can be attached, or a **slip-type,** to which the delivery hose from the machine can be directly attached. The tube itself can be curved or straight. Luer-Lok (Fig. 4–29C) arterial tubes were developed for high-pressure injection. These tubes attach to a connector on the delivery hose much the same as a hypodermic needle attaches to a syringe.

Stopcock. The stopcock is used to attach the delivery hose from the injection device to the arterial tube (Fig. 4–30A). Luer-Lok stopcocks are used for arterial tubes with Luer-Lok attachments (Fig. 4–30B). The stopcock can be used to maintain and stop the flow of fluid into the arterial tube.

Y Tube. The Y tube was developed for the embalming of autopsied bodies. It allows the embalmer to embalm both legs or arms or sides of the head at the same time (Fig. 4–31). Double Y tubes have been developed that allow for injection of four body regions at the same time.

Hypovalve Trocar. The hypovalve trocar is designed for hypodermic treatments (Fig. 4–32). It is **not** used for aspiration but rather for injection.

Drainage Instruments

Drain Tube. The drain tube is a metal cylinder with a cleaning rod designed to be inserted into a vein (Fig. 4–33). Drain tubes are always inserted **toward** the heart. They help to keep the vein expanded and can be closed to build circulatory pressure. The stirring rod can be used to fragment large clots. There are many sizes. Jugular drain tubes are generally very large in diameter and short; axillary drain tubes are often slightly curved; infant drain tubes can be used for small vessels such as the femoral and iliac in the infant. A hose can easily be attached to the drainage outlet so the blood drained can easily be controlled or collected and disinfected.

Angular Spring Forceps. These angular forceps have a working length of 2½ to 7 inches. They are inserted much like the drain tube into a vein and directed toward the heart. They allow clots to be grasped and pulled from within a vein.

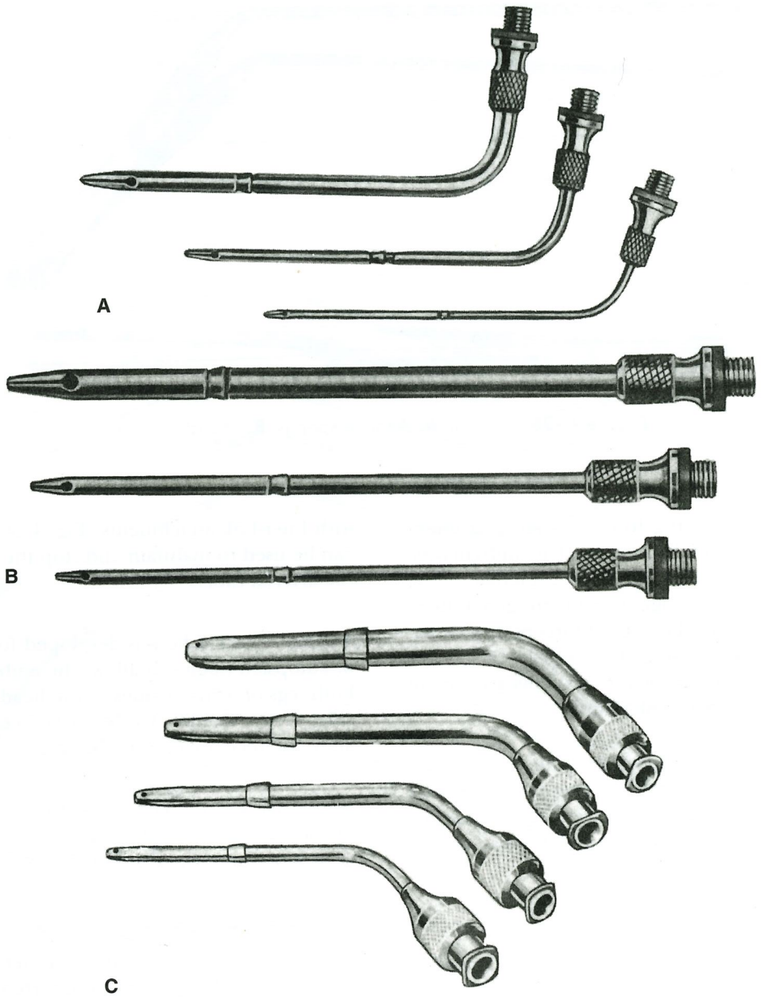


Figure 4–29. A. Curved threaded arterial tubes. **B.** Straight threaded arterial tubes. **C.** Luer-Lok.

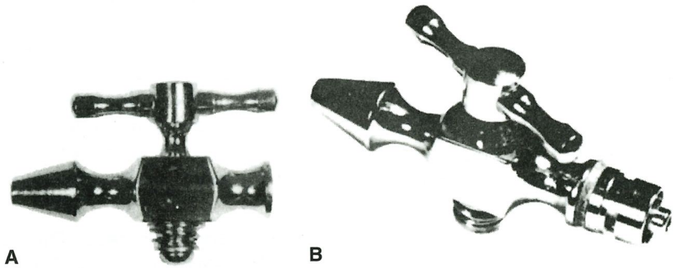


Figure 4–30. Stopcocks. **A.** Stopcock used to attach the delivery hose from the injection device to the arterial tube. **B.** Luer-Lok stopcock used for arterial tubes with Luer-Lok attachments.

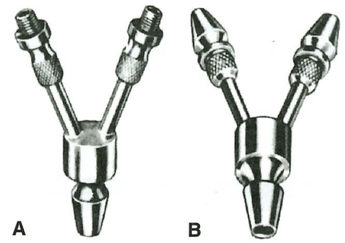


Figure 4–31. A Y tube used for embalming autopsied bodies.

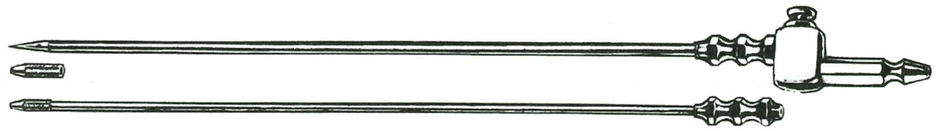


Figure 4–32. Hypovalve trocar. Designed for hypodermic treatments. Used for injection, not aspiration.

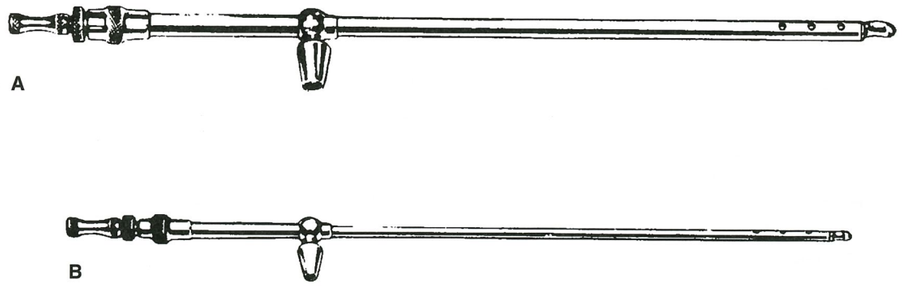


Figure 4–33. Drain tubes can be used to build circulatory pressure.

Figure 4–34. Iliac drain tube. This long tube is designed to be inserted into the external iliac vein.

Figure 4–35. Groove director. Used to expand a vein to help guide a drain tube or drainage device into the vein.

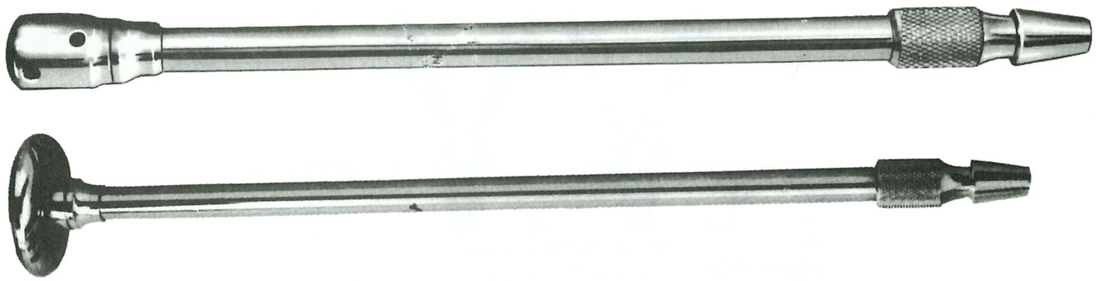


Figure 4–36. Autopsy aspirator. The many openings guard against clogging during aspiration of either blood or arterial fluid from the cavities of autopsied bodies.

Iliac Drain Tube. The iliac drain tube is a long drain tube designed to be inserted into the external iliac vein and the tip is directed into the right atrium of the heart (Fig. 4–34). These tubes may be soft rubber, plastic, or metal.

Grooved Director. The grooved director is used to expand a vein to help guide a drain tube or drainage device such as angular spring forceps into a vein for drainage (Fig. 4–35).

Aspirating Instruments

Autopsy Aspirator. An autopsy aspirator has many openings so as to be "non-clogging." It is used to aspirate blood and arterial fluid from the cavities of autopsied bodies (Fig. 4–36).

Hydroaspirator. The hydroaspirator is an aspirating device that creates a vacuum when water is run through the mechanism (Fig. 4–37). Most hydroaspirators are equipped with a vacuum breaker so aspirated material flowing through the device does not enter the water supply should there occur a sudden drop in water pressure.

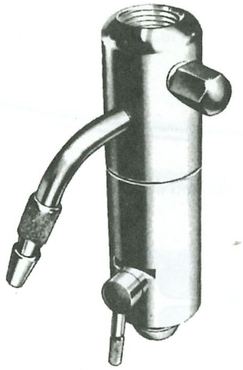


Figure 4–37. Hydroaspirator. This aspirating device creates a vacuum when water is run through the mechanism.

Nasal Tube Aspirator. The nasal tube aspirator attaches to the aspirating hose. It is designed to be inserted into the nostril or throat for limited aspiration of the nasal passage or the throat (Fig. 4–38).

Trocar. The trocar is a long hollow needle. The length and the diameter of this instrument are quite variable (Fig. 4–39). The points are threaded so they may be changed when dull. The handle may be threaded or have a slip hub. Infant trocars are short and small in diameter. They may also be used for hypodermic injection treatments. The standard trocar is used to aspirate and inject body cavities.

Cavity Fluid Injector. The cavity fluid injector screws onto the cavity fluid bottles. When the device is inverted, cavity fluid flows through the trocar into the body cavities (Fig. 4–40).

Trocar Button. A threaded plastic screw used for closing trocar punctures, the trocar button may also be used to close small punctures, surgical drain openings, and intravenous line punctures. They are available in several sizes (Fig. 4–41).

Trocar Button Applicator. The trocar button applicator is used to insert the trocar button (Fig. 4–42).

Feature Setting Devices

Eyecaps. Eyecaps are plastic disks inserted under the eyelids. They keep the eyelids closed and prevent the eyes from sinking into the orbit (Fig. 4–43).

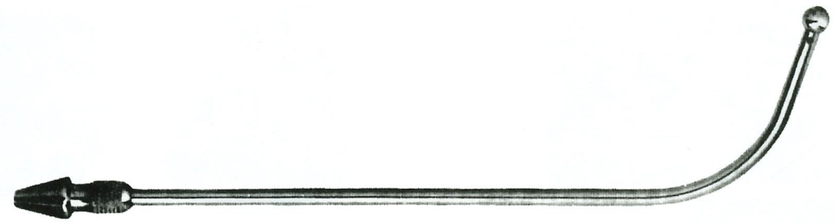


Figure 4–38. Nasal tube aspirator. Attaches to the aspirating hose. Designed for nasal insertion.

Figure 4–39. Trocar. A long hollow needle with threaded points that can be changed.

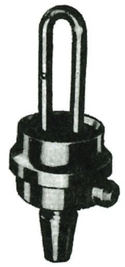


Figure 4–40. Cavity fluid injector. Screws onto cavity fluid bottles.

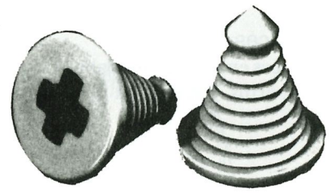


Figure 4–41. Trocar button. Threaded plastic screw used for closing trocar punctures.

Figure 4–42. Trocar button applicator. Used to insert the trocar button.

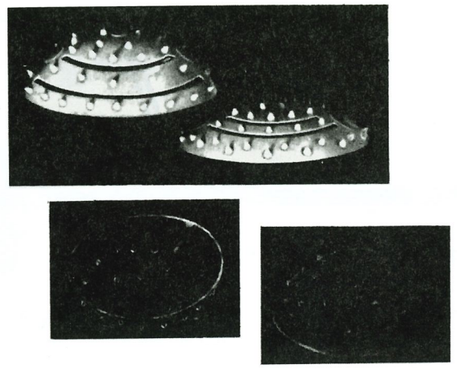


Figure 4–43. Eyecaps.

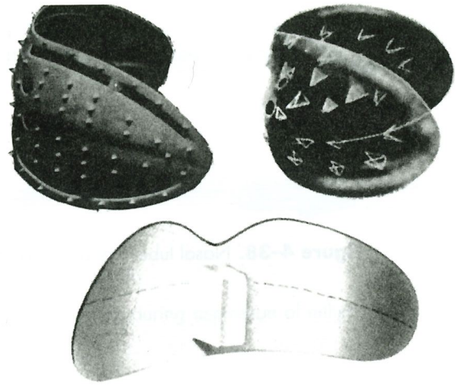


Figure 4–44. Mouth formers.

Mouth Formers. Mouth formers are plastic or metal devices used to replace the teeth when the natural teeth or dentures are absent (Fig. 4–44).

Needle Injector. A needle injector is used to insert a "barb" into the mandible and maxilla to hold the lower jaw in a closed position. Several types of handles are available which can make the device easier to use. An electric version is also available (Fig. 4–45).

Positioning Devices

Positioning devices enable the embalmer to properly position the head, arms, hands, and feet of the deceased. Most are constructed of metal, hard rubber, or plastic. Embalmers often employ specially cut blocks of wood to elevate shoulders, arms, and feet. These devices should be properly painted with a water-resistant paint so they can be cleaned after each use.

Head Rests. Headrests can be used to elevate the head and neck. They can be used to support the arms and raise the feet. A head rest can also be placed under the thigh area to help steady bodies with severe spinal curvature or an arthritic condition (Fig. 4–46).

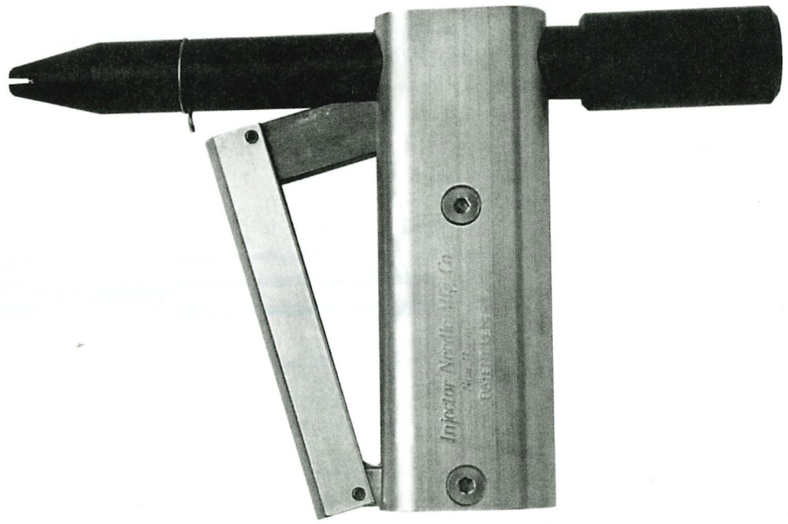


Figure 4–45. Needle injector.

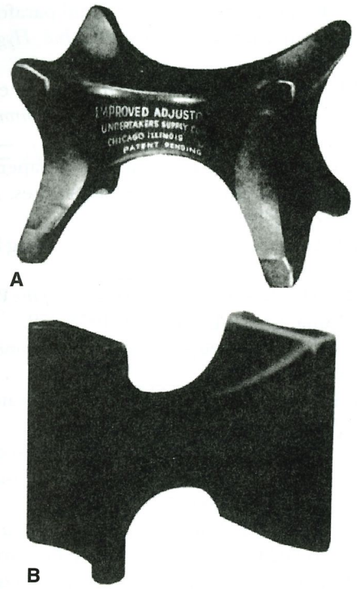


Figure 4–46. Headrests.

Arm and Hand Rests. Arm and hand rests consist of two curved metal arm holders attached by an adjustable strap. The strap rests across the body while the arms are secured in the arm holder. It is designed to fit bodies of different size and retain both arms and hands in a desirable position.

Shoulder, Body, and Foot Rests. Rests of plastic or metal blocks are used to raise shoulders, feet, or buttocks off the table.

▶ PLASTIC UNDERGARMENTS

Plastic garments can be used to protect clothing from conditions such as ulcerations, gangrene, or burnt tissue. They help to control leakage from the tissue donor body, autopsied body or the condition of edema. Those most frequently used include: pants, coveralls, stockings, sleeves, Capri garments and unionalls. With the exception of sleeves, all of those listed come in a variety of sizes. Powdered deodorants and preservatives may be placed within the garment to control odor and absorb any leakage. The coverall covers the trunk of the body from the upper thigh to the armpit. The unionall covers the entire body except for the hands, neck, and head areas (Fig. 4–47). The Capri garment combines pants and stockings.

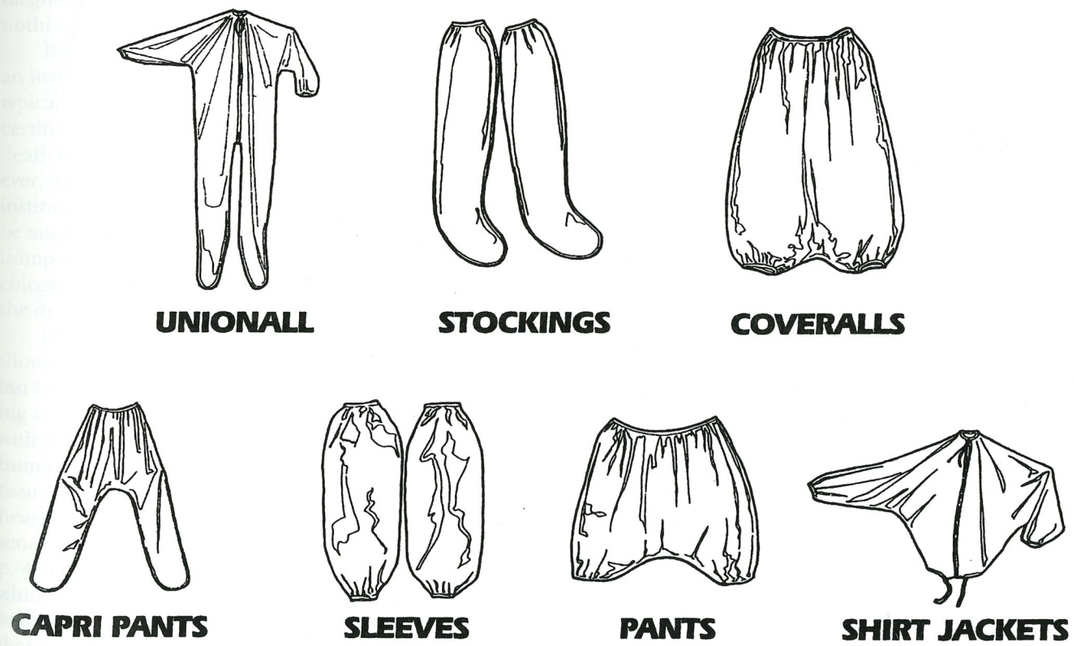


Figure 4–47. Plastic undergarments.

▶ CONCEPTS FOR STUDY AND DISCUSSION

1. List all the instruments you may need to use in the embalming of a non-autopsied body. List all the instruments you may need to use in the embalming of an autopsied body.
2. Discuss the disadvantages of a basement preparation room.
3. Discuss the proper locations for an exhaust system in the preparation room.
4. How does the hand pump differ from the bulb syringe?
5. With reference to the centrifugal injection machine, explain the terms potential pressure, actual pressure, and differential pressure.
6. Review the statutes, rules, and regulations your state has concerning the preparation room.

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CHAPTER **5**

DEATH—AGONAL AND POSTMORTEM CHANGES

CHAPTER OBJECTIVES

- Death—agonal changes
- Postmortem physical changes
- Postmortem chemical changes
- Signs and tests of death

Death is a process and not a moment in time. During the process there is a series of physical and chemical changes, starting before the medicolegal time of death and continuing afterward. In the sequence of death there is a point of irreversibility that can generally be diagnosed by physicians. When this point is reached, nothing more can be done to restore intelligent life.

Because most deaths in the United States occur in an institutional setting, the pronouncement of death is typically the responsibility of persons who have the legal certification and authority to make a determination that death has, in fact, occurred. There are those times, however, where death may occur someplace other than an institution. In such cases, funeral home personnel may be among the first to arrive at a death scene. As such, it is important that they understand and honor the medicolegal relationships that exist in the jurisdiction where the death has occurred.

From a layperson's perspective, death might be thought of as the point at which an individual "draws his last breath." In reality, there is a sequence of steps leading up to that point, and a series of changes associated with the steps. In higher biological organisms, such as humans, these changes result in a cessation of integrated tissue and organ functions. As a result, there is a loss of heartbeat, cessation of spontaneous breathing, and absence of brain activity (*Stedman's Medical Dictionary,* 1995, p. 443). The process takes place in a sequence of steps which can be described as an expanding inability of the body to sustain the physiologic and metabolic processes that are necessary for life. The period of time over which the steps occur is known as the **agonal period**.

The agonal period might be quite short, as would be the case in an accident where death resulted from sudden, fatal injuries. Or, the process might take place over an extended period of time, as would be the case in a death caused by chronic illness. Whether the agonal period is long or short, at a given point in the process, the body can no longer function as a whole organism.

▶ PROGRESSION OF SOMATIC DEATH

Agonal refers to death or dying (*Taber's Cyclopedic Medical Dictionary,* 2001, p. 58). During the agonal period the body is said to be **moribund**, a dying condition, or dying (*Taber's Cyclopedic Medical Dictionary,* 2001, p. 1377). Physical observations that can be made during the dying process include **death rattle** and **death struggle**. Death rattle is a respiratory gurgling or rattling in the throat of a dying person, caused by the loss of the cough reflex and the accumulation of mucous (*Stedman's Medical Dictionary,* 1995, p. 444).

Death struggle is the semiconvulsive twitches that often occur before death.

The agonal period occurs prior to the point in the process where the body loses its ability to sustain vital physiologic and metabolic activities. Once the body loses its ability to sustain physiologic and metabolic activity, **somatic death** occurs. Somatic death is defined as the death of the entire body (*Stedman's Medical Dictionary,* 1995, p. 444). It proceeds in an orderly progression from clinical death to brain death, then to biological death, and finally to postmortem cellular death.