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PLANNING THE OPERATING ROOM

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Anesthetists have long played an important part in surgical operations through their responsibility for administering the anesthetic agent. To a far less extent have they taken an active interest in preliminary planning of operating rooms as a part of new building projects. It seems obvious that the special knowledge of the anesthetist and his responsibility for the patient from the preoperative time through postoperative period equip him to give valuable counsel to the architect and the hospital superintendent who are planning a hospital.

The operating suite is an important element in one of the hospital's principal therapeutic services. Its requirements are complex, its traditions exacting, and as a result its design generally conforms to accepted standards, but its possibilities are still challenging. Understandable concern for the patient's welfare prompts close scrutiny of any proposal to deviate from standards, and need for economy in one of the most costly parts of the hospital tends to discourage experimentation; nevertheless evidence that research is still needed can be found in the number of questions which remain unanswered. No unanimity of opinion or practice can be found on points such as these:

1. How many operating rooms should be provided?
2. What is the acceptable minimum size of operating room?
3. Should patient be anesthetized in the operating room or in a separate room? If separate, what ratio of anesthetizing rooms to operating rooms?
4. Should scrub-up facilities be in the operating room or outside? If outside, should they adjoin it or be centralized?

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5. Should there be central sterilizing or sterilizers adjoining the operating room?
6. What are the essential service rooms?
7. What is the best arrangement and location for these elements?
8. How can you insure against static discharge?
9. Will new anesthetics eventually remove this hazard?
10. How much of the operating suite should have summer cooling?
11. What is the best floor material?
12. What is the best wall material?
13. Do acoustical materials provide harmful dirt pockets?
14. How should color be used?
15. Are galleries desirable? If so, how large? High or low? Portable or built-in? How can movies and television be used for teaching?
16. What constitutes satisfactory lighting?
17. Are germicidal lamps necessary or beneficial?
18. Should equipment be portable or built-in?
19. Are windows necessary?
20. Will a central sterile goods supply system work?
21. Should there be a central workroom?
22. Can steam sterilizers be used satisfactorily for quick instrument sterilizing?
23. Can central instrument storage be planned to eliminate instrument cabinets in the operating rooms?
24. Should recovery beds be provided as a part of the operating room suite?

Scanning this list, one might conclude that about the only thing currently agreed upon is that there should *be* operating rooms. It is not quite as serious as that, but much conscientious research still needs to be done. When the doctors and nurses and the hospital superintendent sit down with the architect and hospital consultant, they set out to formulate a plan. The beginning of a plan is the statement of need. Then follow analysis of the function (who does what), research on accepted practices, a first proposal, criticism by the group, restudy by the architect and repeated criticism and study until an acceptable plan has been achieved.

Probably the most important part in all this is a careful and thoughtful statement of the need. This might well begin with a statement by the surgeon of the minimum (or minimum to optimum) number of operating rooms required to carry the anticipated load. Surgeons usually have the *first, last* and *most respected* voice in such plans. Like most of us, they are likely to insist on what they *desire* rather than minimum requirements, and their request should therefore be subject to careful critical scrutiny. The statement of need should include other essential facilities such as:

Scrub rooms
Sterilizing rooms
Anesthetizing rooms
Nurses' work room
Anesthesia work room and store room
Janitor's facilities
Supervising nurse's office
Surgical stenographer's office
Anesthetist's station
Toilets
Waiting rooms for outpatients
Clinical pathology laboratory
Common room for doctors (men and women)
Nurses room (If dressing room is remote)
Doctors' dressing room—men
Doctors' dressing room—women
Students' dressing room—men
Orderlies' dressing room
Storage rooms for:

- Stretchers
- Extra tables
- Anesthesia equipment and gases
- Splints
- Sterile supplies
- Instruments
- Linen

A recovery ward (one bed for each major operating room)
Galleries
Corridors
Elevators
Stairs and other fixed structural elements

Each planning group must estimate its own needs both on the number of operating rooms and on the number and size of the adjunct spaces listed. In many cases the program will have to be modified to fit available space or to meet a budget. Consideration of all requirements will finally result in a list of spaces similar in character to the one just given.

After the program has been determined, the next step is to analyze the function. Here it is essential to make a flow sheet showing all the people involved and what they do. Those regularly engaged include:

1. The patient
2. Several kinds of nurses
3. The anesthetist and his assistants
4. The surgeon and his assistants

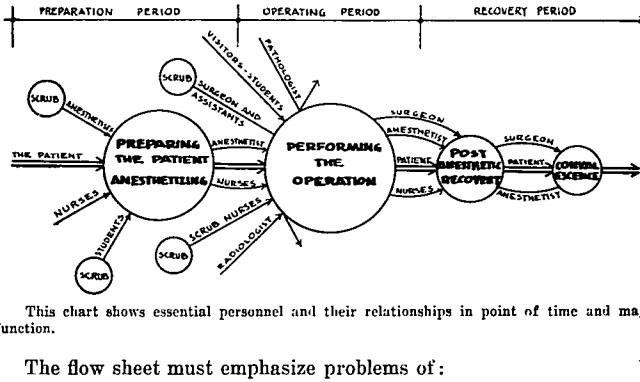
Those more or less frequently involved include:

1. The pathologist
2. The roentgenologist
3. Visitors, students and other observers
4. Relatives and friends of the patient

A combination flow chart is shown (fig. 1) dividing the operation into three sections and showing functionally who does what. A similar, more specific flow analysis should be made as a test of each plan considered, tracing each person as he performs his functions and arranging the specific parts of the plan to provide a minimum of cross traffic and a maximum of convenience. Similar flow sheets should be made for supplies to determine proper storage points and for utilities to determine location of outlets. In this analysis detailed conferences with the surgeon, the anesthetist, and the nurse are essential.

FIGURE 1

Time sequence in operating procedure



This chart shows essential personnel and their relationships in point of time and major function.

The flow sheet must emphasize problems of:

1. *Supervision.*—Supervising nurse and anesthetist should have bird's eye view of all that goes on and should be quickly available to all operating rooms. *The surgeons do not have this problem.*

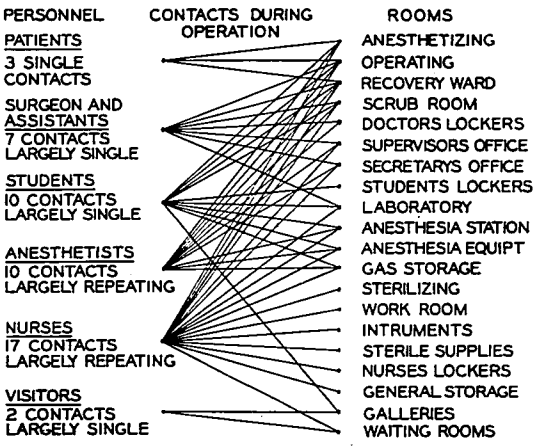
2. *Service.*—Nurses may have to make numerous trips to service rooms during one operation. Flexibility of nursing and anesthesia staffs leads to greater efficiency but is impossible if various stations are isolated (fig. 2).

Intra-operating room suite traffic must include:

1. Multiple service personnel (Traffic during and between operations)

Numerous nurses—some with interlocking activities
Anesthetists
Orderlies
Janitors (Traffic between operations only)

FIGURE 2



2. Single service personnel (Traffic between operations only)
   Patients
   Surgical team
   Scrub nurses
   Visitors
3. Occasional personnel (Traffic either during or between but not frequent)
   Radiologist
   Pathologist
   Consultants

1. *How many operating rooms should be provided?*

After the functional relationships are well established both in quality and in quantity, the planning group is ready to attack specific questions. The first is "How many operating rooms should there be?" This depends on answers to a number of other questions.

A. What is the actual available space? Can it be enlarged or modified?

B. What fixed structural elements must be retained?

C. How many general hospital beds are to be served?

D. Of these how many will be served by this suite? For example, is there a separate women's building with operating rooms for gynecology or a cancer institute for those cases or an orthopedic institute with operating rooms for its cases or a children's building with operating rooms?

E. How many rooms will need to be assigned exclusively to specialties—ophthalmology, otorhinolaryngology, bronchoscopy, cystoscopy, orthopedics, neurology?

F. Will the operating schedule be for mornings only or will it include morning and afternoon operations? (Obvious economy if it does, but provide against overlapping.)

G. What outpatient load, if any, must be carried?

H. Is the suite to provide for emergency service?

I. Is the service in a voluntary or a governmental hospital?

J. Is there teaching in the hospital?

K. What is the duration of the average operation?

No formula can be presented which will take the answers to these questions and give in return the proper number of rooms. Experience has shown that each general operating room may be expected to take care of 400 to 650 operations per year. Judgment of the data collected will determine where in this range your hospital will fall. The solution will inevitably mean reconciling needs and limitations. Try to work out the optimum number which space and budget will permit. The trend is toward less specialization and more flexibility in the planning and toward more intensive use of each room. Both these trends mean relatively fewer rooms.

2. *What is the acceptable minimum size?*

Here again an important question is: What will the fixed design permit? Other questions must also be answered, for example: Will there be separate rooms for scrub-up and sterilizing? Are there to be galleries and if so, built-in or portable? Will teaching be done? Will equipment be portable or built-in? To what are your doctors accustomed?

(The range in size seems to be from 16×18 up to 20×22.) Do not underestimate the importance of the last question above in de-

termining sizes. If too many operating rooms are required for the size of your budget, they may have to be made smaller, and other facilities will have to be condensed. The wider the operating rooms are (along the corridor) the greater the distances to be covered by supervising and service personnel (but the more corridor space there will be). If teaching is to be done directly on the floor, determine the number of viewers to be provided for and allow floor space for them in addition to all the service personnel.

3. *Should patient be anesthetized in the operating room?*

The trend on this point seems to be toward use of separate rooms for preparation, including anesthetizing and in some cases the beginning steps in the operation. Use of the operating room for anesthetizing ties it up unnecessarily and reduces the number of operations possible per room. Careful planning of space for anesthetizing might conceivably result in reducing the number of operating rooms required. Opinions on the number of anesthetizing rooms vary from two for each operating room to whatever number can be included. A desirable minimum is two anesthetizing rooms for each three operating rooms. Anesthetizing rooms should lead directly into the operating rooms with wide doors (12 feet) wherever it is expected to begin the operation in the preparation room and continue it as a demonstration in the operating room.

4. *Where should scrub-up facilities be?*

In smaller installations and emergency rooms, scrub-up facilities may be in the operating room, using a combined scrub-up and instrument sink. In larger institutions it is commonly just outside the operating room. In some plans a central scrub room is shown, in which case the scrubbed surgeon may have to walk some distance to his operating room. Where students are being taught scrubbing technics, it is thought the scrub-up should immediately adjoin the operating room to prevent contamination of a scrubbed student passing through the corridors. Opinions differ as to whether scrub space needs to be separated from the corridors by a door, but it must lead directly into the operating room, and a handy arrangement includes a viewing window which permits the surgeon while scrubbing to watch preparation being made in the operating room.

5. *Central sterilizing or adjoining operating room?*

The answer to this question seems to be a little of both. Sterilizing should be centralized as much as possible without requiring extra steps during the operation. In general, sterilizing of everything but instruments can be done at a central station, but sterilizing of instruments both during the operation and at other times, and sterilizing of other objects which must be done quickly during the operation can better be handled in a substerilizing room immediately adjoining operating room.

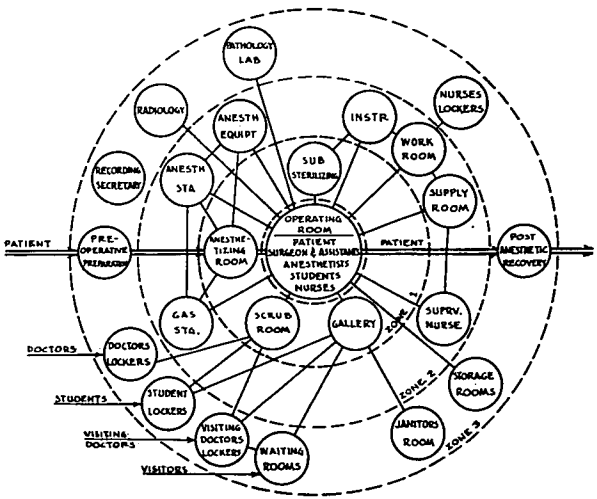
Here the question whether to use water sterilizers or a high speed autoclave must be considered. Careful study should be given all functions in locating central sterilizing and other adjunct operating aids. In this the counsel of the anesthetist, the surgical supervisor and nurses is most important, with the surgeon's opinion taken as valuable but secondary. The surgeon's requirements are dressing room, scrub room, sterilizing room and operating room. Here his views should carry most weight, but as regards *coordination* within the operating room suite, the opinions of those who have responsibility for *all* the operating facilities deserve the greater consideration.

6. *What are the essential service rooms?* (Fig. 3.)

A. The immediate service rooms, the operating rooms, anesthetizing, scrub-up, and sterilizing have been mentioned. In addition to these, there are other essential rooms such as anesthesia station and storeroom, a recovery ward and its service rooms, and a clinical pathology laboratory.

FIGURE 3

Individual preferences may put some elements (such as scrub room if a central scrub unit is used) in different zones from those indicated. Study of specific requirements will reveal the proper relationships in each case.



Zone 1. Elements are required for each operating room and represent the closest traffic relationships.

Zone 2. Elements may serve several operating rooms and may be less close to operating room.

Zone 3. Elements will serve several operating units and may be even more remote.

B. Supervision includes the supervising nurse's station and the anesthetist's station centrally located to permit maximum supervision with minimum travel.

C. Work rooms should include a central clean-up space with utility sink, sterilizer, storage cabinets, work tables and adjoining it rooms for instruments, sterile supplies, gloves, solutions, splints and a janitor's closet.

D. Storage rooms should be provided for stretchers, extra tables and linen, and space must be set aside for mechanical equipment. Storage space for gas machines and separate storage space for gases are essential. If anesthetists supply their own machines and gases individually, more storage space will be required but less supervision will be necessary.

E. Certain comforts and conveniences are important. These include waiting rooms, toilets, corridors, telephones, a doctors' common lounge located near the operating rooms and near the entrance to the suite and a surgical stenographer's office. Adequate provision should be made for staff dressing rooms on the same floor, and if viewing galleries are such that spectators must change clothes, rooms should be provided for their use, preferably on the floor above. These should be arranged to keep all visitors away from the work center and should include dressing rooms for both men and women doctors. Similar rooms on the floor should be provided for staff doctors, nurses, students and orderlies. If the nurses' locker room is remote from the operating rooms, a small nurses' rest room should be near by.

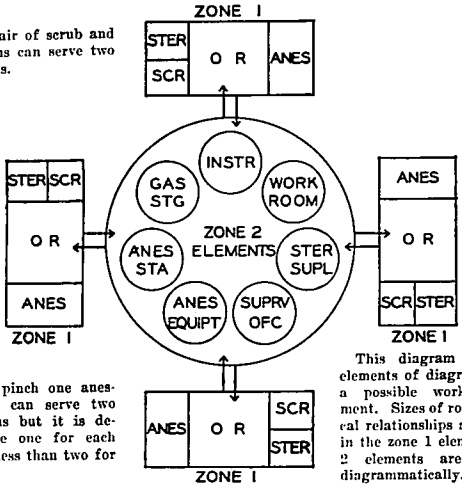
7. *What is the best arrangement and location for these elements?*

At this point careful study will be given many possible arrangements within the limitations imposed by structure and cost (fig. 4 and scale plans). A few basic plans have been in general use, but new ones are being suggested continually. The ultimate goal is the ideal utilization of available space. Structural expense should be balanced against operating expense, for example, an inefficient plan accepted to curtail initial investment may throughout succeeding years result in greater expense because of increased personnel requirements. It may result in less service (fewer cases done or more time wasted). It may result in loss of life because of difficulties of supervision. It may be a constant source of irritation. The answer to this question really depends on your own architect, hospital consultant, hospital administrator and other planners involved. The rooms listed under question 6 include in group "A" the operating room, anesthetizing rooms and others constituting the essential core. Next, those in group "B" cover essential supervision of all functions. Next, group "C," those rooms for all work not an integral part of the operation; next, group "D," storage space, and in group "E" public space. All rooms listed are important but their degree of importance is represented roughly by the order given. Thus, if budget or space limitations force reductions, the first effort should be to combine elements within each group starting with

FIGURE 4

Diagrammatic plan of four operating units with central service elements

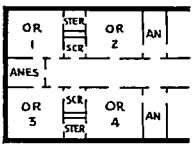
Note: One pair of scrub and sterilizing rooms can serve two operating rooms.



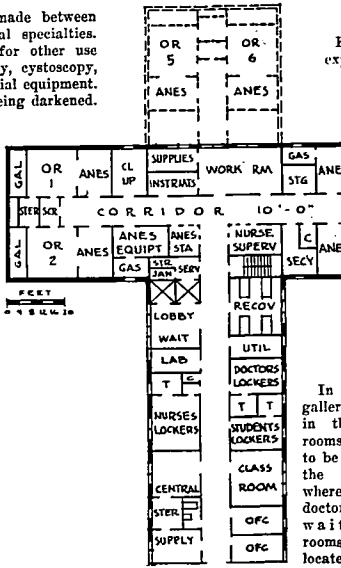
Note: In a pinch one anesthetizing room can serve two operating rooms but it is desirable to have one for each O. R. and not less than two for three.

This diagram regroups the elements of diagram No. 3 into a possible working arrangement. Sizes of rooms and physical relationships are established in the zone 1 elements but zone 2 elements are still shown diagrammatically.

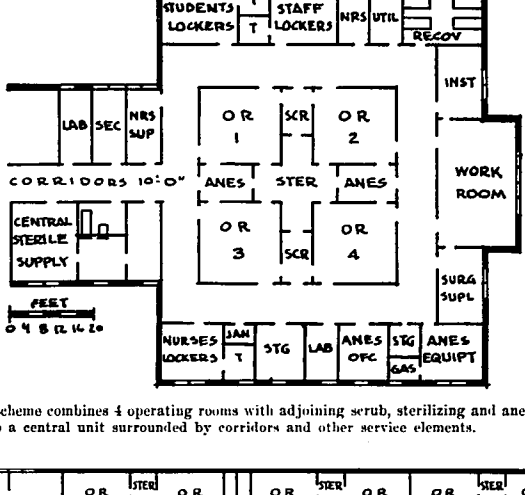
No differentiation has been made between general surgery and the surgical specialties. Rooms shown can be modified for other use such as orthopedics, bronchoscopy, cystoscopy, etc., with proper attention to special equipment. All rooms should be capable of being darkened.



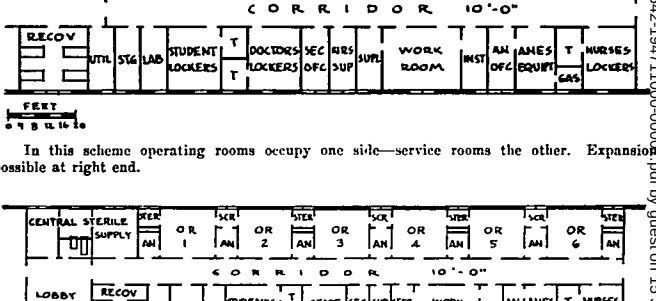
A variation or expansion of the plan showing 4 operating rooms and 3 anesthetizing rooms. Galleries are omitted if three such units are used in place of the three pairs shown, central service rooms should be increased by 60 to 75%.



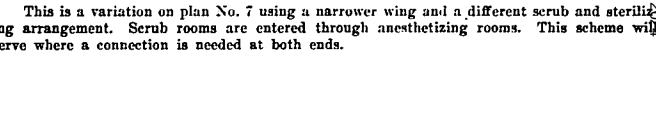
In this scheme galleries are shown in the operating rooms. They are to be entered from the floor above where the visiting doctors' locker and waiting rooms rooms should be located.



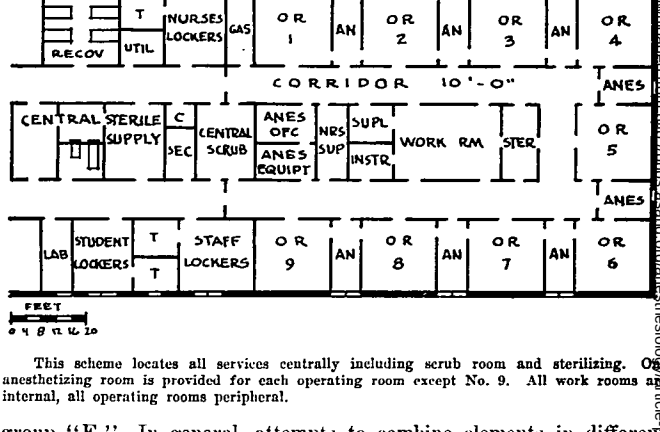
This scheme combines 4 operating rooms with adjoining scrub, sterilizing and anesthetizing rooms into a central unit surrounded by corridors and other service elements.



In this scheme operating rooms occupy one side—service rooms the other. Expansion possible at right end.



This is a variation on plan No. 7 using a narrower wing and a different scrub and sterilizing arrangement. Scrub rooms are entered through anesthetizing rooms. This scheme will serve where a connection is needed at both ends.



This scheme locates all services centrally including scrub room and sterilizing. One anesthetizing room is provided for each operating room except No. 9. All work rooms are internal, all operating rooms peripheral.

group "E." In general, attempts to combine elements in different groups should be avoided. Thus the maximum program would include all spaces listed and the minimum would include all the functions listed condensed into as few rooms in each group as is physically possible. The final determination will be by trial and criticism following counsel from all interested parties.

Numerous special questions come to mind regarding details of planning and construction which cannot be considered here. These include: How can you insure against static discharge? Will new anesthetics eventually remove this hazard? How much of the operating suite should have summer cooling? What is the best floor material? What is the best wall material? Do acoustical materials provide harmful dirt pockets? How should color be used? Are galleries desirable? What constitutes satisfactory lighting? Do germicidal lamps do any good? Are windows necessary? How much of the sterilizing and packing of operating room supplies will be done in a central sterile supply unit? How can movies and television be used for teaching? Can central instrument storage in the operating suite be planned to eliminate cabinets in the operating rooms?

Today's hospital planning emphasizes no single service to the exclusion of others but tries to provide both general and special services for all patients. The surgical operating suite is an essential adjunct to a principal service. It takes its place with the other important therapeutic services, radiology, physical therapy, occupational therapy, pharmacy, dietary, and nursing in giving the patient the maximum chance to effect a natural recovery. Contrary to the old gag, an operation cannot be a success if the patient does not recover, nor is a plan successful unless it serves to aid both the operation and the recovery.