

Requirements for the design and implementation of modern hospital operating rooms

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Abstract:

The research paper reviews the design principles of operating room (OR) in hospitals, architectural design and execution skills, and various interior architectural finishes, according to the latest standards and techniques which have used various systems that require knowledge of the architect in the design process or during the implementation of these sensitive spaces. Given the sensitivity of these Rooms and the urgent need to shed light on these subtle details, the research presents in the first part the theoretical study of operating rooms and the historical background of operating rooms as well as the historical development of operating rooms in hospitals and the development of their internal finishing, through a presentation of the Egyptian code for hospitals, the section on operating rooms and their various requirements, the researcher followed in the second part of the research, the descriptive approach of the researcher's previous experience in the field of health care buildings, and the analytical approach of the Standard Code Group (AIA) as an applied model, the requirements of which were dealt with by the researcher.

It also contains an applied study for the design and implementation of the operations wing of the Neuroscience Department at King Abdullah Medical City, the Specialist Hospital in the Holy capital Makkah City, as an applied model for a methodology of reviewing the contents and foundations of the design and implementation of specialized operating rooms, which the researcher designed and implemented, which was based on the American code for design (American Institute of Architecture) (AIA) as a reference approved by the Ministry of Health in the Kingdom of Saudi Arabia, and it includes the proposed checklist matrix for the design, implementation and operation of operating rooms and the main items of the integrated design process in a simplified way to verify the integrity of the design elements in the operating room, which can be applied and guided when designing and implementing operating rooms. The research is concluded with a group of various results and recommendations to achieve integrated operating rooms, and to develop recommendations for developing operating rooms in a manner consistent with the great development in the field of health care and various specialized medical equipment, which must be accompanied by a major development in the design and implementation of operating rooms.

Key words:

(technologies - operating rooms - health care - hospitals – finishing)

Introduction:

OR (Operation rooms) in hospitals are among the most complex architectural spaces in terms of architectural design or interior details and medical equipment, due to the sterilization and infection control requirements that necessitate preventing the transmission or spread of

infection to and from the room during the surgical procedure, where the patient is more vulnerable to infection with pollutants or harmful microbes during surgery, which makes his/her infection more unwanted complications, and the presence of pollutants in the room may cause the death of the patient, God forbid at times, and due to the lack of Arabic references in this field (other than the presence of the specifications of the Building and Housing Research Center in Egypt, version 1, 2) Which deals with this topic in extended details, the researcher tries to mention the details of the design of this room based on practical experience in using the American Code for Design (AIA) and the specifications of the Ministry of Health in the Arab Republic of Egypt (publications of the National Center for Building and Housing Research) and the requirements of the Ministry of Health in the Kingdom of Saudi Arabia, and the experience of Execution of this type of précised architectural vacuums with special requirements.

Research problem:

Hospitals contain spaces with high sensitivity, such as operating rooms, which need a thorough study to properly perform the desired goal in line with the modern technology of medical equipment used in these spaces.

Lack of awareness of the importance of using local and international codes when designing operating rooms, which hinders the implementation of some types of specialized operations due to poor preparation of these rooms.

Research goal:

The research aims to shed light on the importance and sensitivity of operating rooms as a major part of hospital components, and to present modern models for advanced operating rooms and a methodology for verifying the suitability of operating rooms for the types of surgeries performed in them.

Research assumes:

Achieving integration between the functionality of the operating rooms, the finishing materials used in the room and the appropriate equipment to achieve the highest quality within the architectural space of the operating rooms.

Research Significance:

The importance of the research is due to the necessity of full awareness of the requirements of general and specialized operating rooms, which are reflected in the architectural design of the space and the quality of finishing.

Research Methodology:

The research followed several scientific research approaches, firstly the descriptive approach by describing the research topic and its various technical aspects supported by local and international documents and codes (collecting data from various sources), then analyzing the data resulting from collecting information and notes on the practical implementation of the operating rooms (case study) in order to reach a methodology that helps achieve the research objective.

Hospital operating room:

Definition of hospital operating room:

The operating room (OR) is a functional architectural space in hospitals, dedicated to conducting a surgical intervention to remove or add an element inside the patient's body, which requires providing a suitable environment completely free of bacteria and contaminants of all kinds, and tight sterilization of all parts and components in the room.

Historical background of operating rooms:**Pharaonic civilization:**

The ancient Egyptians excelled in medicine and it came to our knowledge through a manuscript dating back to the year 1700 BC. That was found by Edwin Smith, there was the presence of a description of the brain that was compared to the anatomy of the human brain and it was found to be identical to it, also Egyptian surgical tools were developed and used until the middle Ages.

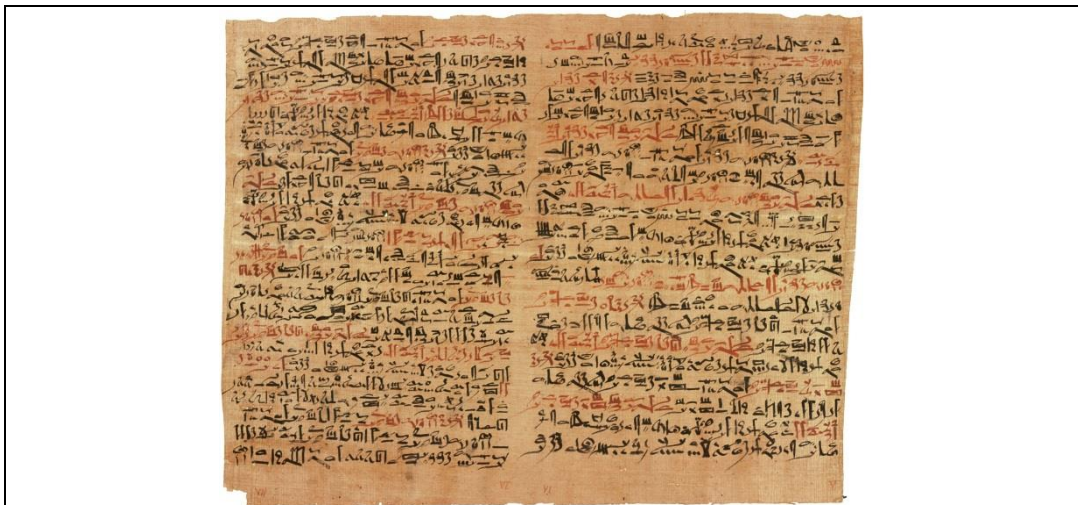


Figure 1-1: The Edwin Smith Papyrus in the Rare Books Room, New York Academy of Medicine

Types of operations unit:

The operating room is an environment in which all sources of pollution and any subtle environmental changes are completely controlled. It cannot be achieved only through careful planning and maintenance and periodic inspection, perfect design for all its support and room service elements, as well as continuous training of appropriate staff .

Design Considerations for Operations Suites

There are several styles of operating suites, the most important of which are: single-lane, two-lane, and sterile-core, and this division depends on the course of users and the sterile and contaminated tools.

In addition, a mechanical means of vertical communication should be provided to connect the patient rooms to the operating ward with an appropriate exit to the mortuary.

- The appropriate distribution area for the ward, in order to avoid intersecting movements of visitors or patients and medical equipment.
- Sufficient and appropriate space allocated according to the design elements that are used and required for the operations suite.

- Provide an emergency exit.
- Provide for ventilation and temperature control, taking into account the need for laminar flow, HEPA filter air conditioner etc.
- Providing a suitable flat for operating rooms and their support services according to the hospital's capacity and the hospital's specialization program.

Components of surgical rooms:

Standard dimensions:

The number and size can be according to the requirement but the recommended size is 6.5m x 6.5m x 3.5m. With the ability to place openings or windows on an external view, if this is possible.

Special technical requirements:

Distribution of electrical outlets: suitable electrical points on the wall (at a height of <1.5 meters from the ground), and they can be within the arms hanging in the room to prevent the presence of connections and wires to the floor of the room (which may impede the movement of the medical team during the operation), and the room must be provided with a sufficient number of power outlets to cover all devices and equipment that are used during operations (all sockets must be connected to emergency source and UBS batteries), and the electrical engineer must review electrical equipment loads and fully calculate the diameter of the wires and the type of appropriate power outlets, and a sticker must be placed on it to distinguish Between backup and normal outlets.

2-1 Models:



Figure (1-5): day surgeries Center Specialist Hospital, King Abdullah Medical City in Makkah

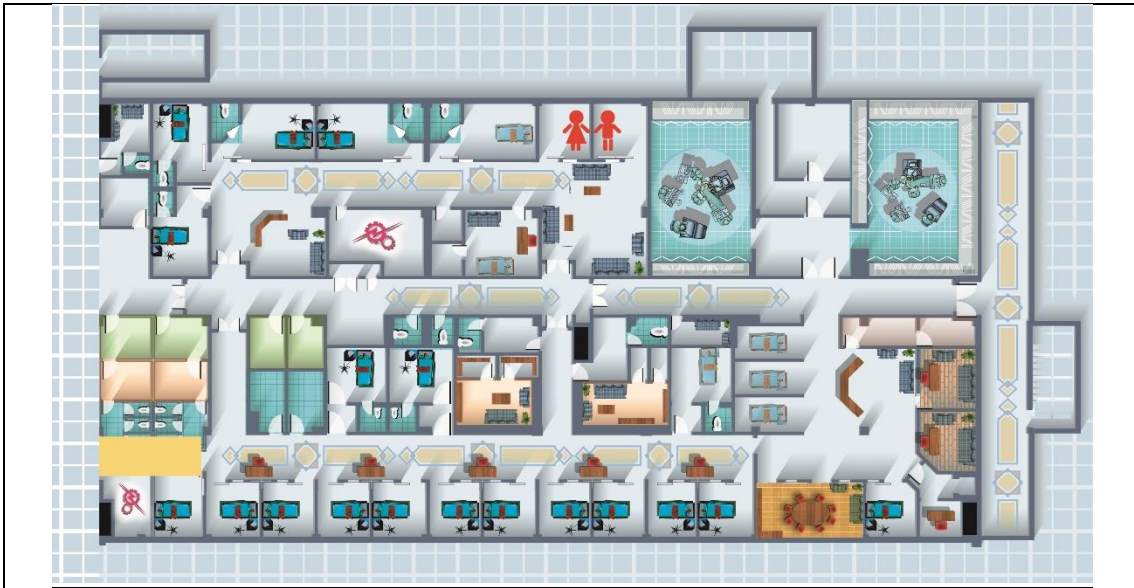


Figure (7-1): Architectural design for the Department of Neurosciences and Neurosurgery at the Specialty Hospital in King Abdullah Medical City in Makkah



Figure (1-8) (1-9): The main operations of the brain surgery room during the process of construction, it shows the processing room of radiation and insulation, Lead Specialist Hospital, King Abdullah Medical City in Makkah



Figure (1-11): The air unit above the patient's bed, laminar air flow, at the Neuroscience Center at King Abdullah Medical City in Makkah



(Figure 1-10): Special Operations room after spine surgeries final finishing, Center for Neuroscience, King Abdullah Medical City in Makkah

Checklist for operating rooms for the case study form (Department of Spinal Cord and Neurosurgery, King Abdullah Medical City, Makkah):

Results:

- 1- The degree of the quality of the architectural work is related to the extent to which the requirements of the space are fulfilled, the function and the aesthetics, and the use of the scientific and practical aspect in making the most of the space in a manner that ensures the safety of the user and the proper performance of the goal of the design.
- 2- The architectural design of the operating suite in hospitals depends on determining the nature of the operations, and the good design of the movement of users, materials and the patient inside the ward.
- 3- At the present time, there are many recommendations for achieving the highest level of patient safety from pollutants and ease of movement of medical staff and equipment inside the operating rooms, and they vary from requirements related to the characteristics of the finishing materials, and the space required for the room in light of the new medical equipment and technologies in this field.
- 4- The architect participates with an integrated work team from different engineering specialties (structural, electrical, mechanical, safety), medical engineering, and a group of specialized administrators and technicians in addition to the medical staff used for blanks in the preparation of the project, without prejudice to the international and local codes of the relevant design.
- 5- The cost of the project can be controlled after setting the basic plan for it on the highest equipment, then moving to the stage of cost reduction (if the owner requested it) by using the least expensive materials, but without prejudice to the main function of the space.

Recommendations:

- 1- The necessity of periodic updating (at close intervals) of the local codes for the design of medical vacuums, in accordance with the requirements of modern and global infection control and prevention, and modern technologies in equipping operating rooms.
- 2- Establishing specialized periodical committees to review the application of codes for designing operating rooms.
- 3- Ensure that operating rooms are fully operational with the help of a team specialized in conducting calibration and measurement of medical spaces, especially operating rooms.
- 4- The bodies concerned with granting permits to practice the profession of architectural engineering must verify the competence of the architectural designer, and determine the specialty of architectural design according to the actual practice and the personal study of the engineer.
- 5- Providing the operating rooms with permanent monitoring devices for the operating systems in the rooms and monitoring them permanently to prevent malfunctions in the systems during the operation of the room.

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