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### An Innovative Technological Building

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**The new Surgery and Emergency Centre of the University Hospital Authority S. Orsola-Malpighi Polyclinic of Bologna was inaugurated in September 2010. This is a technological building of about 25,000 m<sup>2</sup>, which includes the following functions: Emergency Department, Diagnostic Imaging, Operating Blocks and Intensive Care Unit, as well as a new Central Sterile Supply Department for surgical instruments intended to serve the entire polyclinic.**

The new building is directly connected to the existing pavilions "Nuove Patologie" and "Nuova Ala", which include wards for a total of 400 beds, allowing an integrated approach with the emergency department and the operating blocks. The construction of the new surgery centre, which began in July 2007 and ended in September 2010, also included the renovation of the emergency medicine department for about 1,000 m<sup>2</sup> and of the facilities in the A and B wings of the "Nuove Patologie" pavilion. The new development had a total expenditure of approximately 40,900,000 euro, which corresponds to about 1,550 euro per m<sup>2</sup>.

The University Hospital Authority S. Orsola-Malpighi Polyclinic, located in the heart of the city where it extends over one kilometre, houses the Faculty of Medicine of Bologna University and represents a national and international reference centre for different diseases.

The S. Orsola-Malpighi Polyclinic is a hospital complex organised in pavilions (a total of 31 halls) for a total area of about 305,000 m<sup>2</sup>, plus about 25,000 m<sup>2</sup> for the new Surgery and Emergency Centre and about 41,000 m<sup>2</sup> for the new Cardiology Centre, currently under construction.

#### The Rationale

The construction of the new surgery centre is part of a development plan for the building, technological and urban arrangement of the polyclinic, which started in 1999 and was subsequently confirmed and updated by the new "Master Plan to 2015", presented and approved in 2007.

The "Master Plan to 2015" aims at offering an integrated spatial configuration organised in building units in order to promote integration of the inter-disciplinary care pathway and even greater management efficiency. The plan provides the merging of healthcare and research/education activities in seven buildings, keeping consistent with the departmental structure of the hospital:

- Surgery and Emergency Centre (new construction);
- Cardiology Centre (new construction);
- Medical, Geriatric, Rehabilitation Centre;
- Mother-Child Centre;
- Oncology and Hematology Centre;
- Day care activities and host functions centre; and
- Education and Research Centre.

In the two newly-built centres (surgical and cardiology) diagnostic and therapeutic functions of high technological impact are gathered together ensuring hospital functions could be adequately accommodated in the existing buildings renovated for such activities.

The expected benefits for patients are numerous and the gathered functions will avoid long journeys inside the hospital. For the first time, an important area devoted primarily to research and teaching (Education and Research Centre) has been identified with positive effects for students and interns.

The main actions are in progress, and their completion is expected during 2013:

- The cardiology centre, currently under construction, will have an area of approximately 41,000 m<sup>2</sup>. The structure was designed to ensure a high level of comfort and functionality of interventional cardiology and cardiovascular surgery areas, together with a large area for other highly specialised activities and intensive care. The functional layout of the spaces will adopt a care model based on the intensity of the treatment;
- The extension of the paediatric pavilion by the incorporation of the ex-emergency room for adults. The acquisition of approximately 5,000 m<sup>2</sup> will allow a more rational organisation and functionality of paediatric activities;
- The oncology centre project will include the renovation of the medical clinic and hematology pavilions, allowing the gathering of all medical and haematological oncology activities in an area of 17,000 m<sup>2</sup>, with appropriate diagnostic imaging systems;
- The new central heating and co-generation system, for which the competitive tender for construction and management (project financing) has been launched, will guarantee energy supplies to the polyclinic for the next 30 years with significant energy savings and lower operating costs if compared to current systems dated back 40 years ago; and
- The renovation of the infectious diseases pavilion.
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Upon completion of this plan of new buildings and renovations, the percentage of areas with medical functions meeting the requirements for accreditation will rise to 80 percent.

## The Surgery and Emergency Centre

The surgery and emergency centre building, which is spread over five floors above ground and one basement, has a rectangular plan with a length of 110 m and a width of about 30 m and it has the following intended uses for each floor:

### Ground Floor:

- General and Orthopaedic Emergency Room
- Emergency Radiology

### First Floor:

- Diagnostic Imaging
- Central Sterile Supply Department (CSSD)

### Second Floor:

- Operating Block (six operating rooms)
- Management area – medical offices

### Third Floor:

- Operating Block (six operating rooms)
- ICU (22 beds)

### Fourth Floor:

- Technological facilities

### Basement:

- Changing rooms
- Deposits
- Technological facilities

On the Ground floor there are the Emergency Rooms (ER), divided into general and orthopaedic, and emergency radiology. Getting to the ER (Fig. 1, page 34) is through a large entry vestibule located on the east side of the building in which three different entrances are provided: One dedicated to patients who go to the ER on their own, which allows them to immediately join triage for the assignment of a priority code, another one dedicated to emergencies arriving at the ER by ambulance, which allows to easily reach the red and yellow code treatment area, and finally one provided with a clean-up room.

On the south side of the building the pedestrian entrance to the ER is located, controlled by a reception area/office adjacent to the large waiting area for patients with white and green codes and their companions. The triage is performed in a room of more than 38 m<sup>2</sup>, located between the waiting area and the waiting area for stretchers, where a preliminary patient inspection can be done in order to define the priority code.

The operational area of the ER is divided by intensity of treatment: The unit with greatest intensity (red and yellow codes), which is accessed by a direct connection from the entry vestibule, consists of eight boxes of about 14 m<sup>2</sup> each for yellow codes, while the red codes have an operating room of 30 m<sup>2</sup>. There is also an interventional/intensive room with three stations.

The area for the green and white codes, which is completely separated from the red and yellow codes, has 11 multi-specialised clinics and two orthopedic clinics, as well as a plaster room.

Both operational areas, at higher and lower intensity of treatment, are equipped with control zones and independent support rooms and are connected with the shortstay observation area, which is structured as an open space with nine boxes of 9 m<sup>2</sup> each separated by sliding curtains and with a central zone for personnel control/work. On the west side of the building, coplanar and contiguous with the ER, the emergency radiology is situated. It includes three x-ray rooms, a CT scan and an ultrasound outpatient area. There are also waiting areas for stretchers and support operational rooms.

A strategic choice implemented in the new surgery centre was to build a second entry vestibule opposite the ER dedicated to move the inpatients. In fact, in a pavilion-structured hospital, the transfer of patients from one building to another is via ambulances, thus requiring an entry area dedicated to this type of transfer. The entry vestibule for the inpatient, through a dedicated corridor, is put in direct communication with the vertical connections inside the centre and with the one in the "Nuove Patologie" pavilion. The ER is connected to the upper floors of the building by four stretcher carriers allowing rapid transfer of patients to the operating blocks and ICU. The emergency medicine area, functionally connected to the ER, is located on the first floor of the pavilion "Nuove Patologie". This area, managed by the emergency physicians, can accommodate patients who, at different levels of complexity, require a further period of observation and investigation after the preliminary ER treatments, prior to being discharged or transferred to wards.

The first floor of the surgery centre houses the diagnostic imaging area for external users and inpatients and the new central sterile supply department (CSSD) of the hospital. The diagnostic imaging area includes five x-ray rooms, a CT scan and two ultrasound outpatient areas. This new location will enable a significant improvement of the service with for logistic advantages. Five new high-tech equipments, which will enable a significant improvement in diagnostic quality, were installed. In particular one 64-slice multi-detector CT equipped with the most advanced diagnostic software including those for studying the heart and coronary arteries, two direct digital RX-systems, one direct digital remote-

controlled RXsystem and one high-level ultrasound scanner.

In the west half-plane the new CSSD is located of about 1,100 m<sup>2</sup>, which will serve the new operating theatres of the centre and all operating rooms and wards of the hospital. The new CSSD, unique for the whole hospital, conforms, certifies and tracks the processing and handling of surgical instruments and medical devices.

The CSSD was designed to optimise both material and operator flows. In fact, two distinct blocks of changing rooms are planned, one for employees working in the unclean area which is in direct communication with the washing area, another for employees operating in the packaging and sterile areas, which will have an additional filter before entering the two operating areas. The CSSD will be discussed in greater detail in the next issue of (E)Hospital.

#### Operating Theatres

The operating theatres are located on the second and third floor consisting of a total of 12 rooms, spread over two operating blocks of six rooms each. The block on the second floor is devoted to specialist surgery (ENT, maxillofacial, plastic surgery and orthopedics), while the one on the third floor is dedicated to general surgery activities, including emergency.

The operating theatres are located on the eastern half planes of the building. The entry to each of the two operating blocks is characterised by a 45m<sup>2</sup> wide entrance/waiting room for patients. Operators enter the theatres through the north corridor where surgical activity support rooms overlook. Each operating room has a dedicated area for patient preparation and a scrub area for the surgeons.

Operating theatres are square-shaped, have an area of about 48m<sup>2</sup> and have been built using prefabricated modular walls that provide flexibility and easy maintenance of technology and facilities. The doors of the room, provided with large windows, have an opening of 160 cm in order to allow easy passage of patient bed. The walls adjacent to the doors were supplied with additional windows, allowing easy control of the inside of the room without interfering with ongoing surgical activities.

The rooms are equipped with fixtures such as surgical ceiling mounted pendant, anesthetic ceiling mounted pendant, operating light and a system for routing of surgical images to monitors on the surgical field and for video streaming over LAN or IP network for consulting or educational activities. Large closets for storage of clean material to be used during surgery are integrated into the walls of the rooms.

With the construction of the operating room great care has been taken over standards of hygiene by providing flushwith- wall installation of electrical outlets, medical gas and control panels, that allow easy and effective cleaning of surfaces.

Regarding ventilation in the operating rooms, the use of laminar airflow implants was considered with the aim of both performing a critical analysis of the development and management costs of such systems over traditional ones and of evaluating the actual role played by laminar airflow systems in the prevention of surgical site infections. Given the results of the recent literature, the choice of using laminar airflow implants has been completely revised due to the lack of scientific evidence on the usefulness of such systems for the prevention of infections, in addition to high costs and discomfort for the operators. It was therefore decided to use conventional ventilation systems with 15-20 air exchanges/ hour. The patient exits the operating room on the opposite side of the entrance to the operating theatre and the 12 hour recovery room area, where the patient will be monitored by staff in the hours after the intervention, can be reached through the south corridor. This environment, facing south, has natural light thus ensuring a high level of patient comfort after surgery.

The staff of the surgical block can enter the operating area by pass-through dressing- rooms that communicate with the south corridor of the operating rooms. The western half-plane of the second floor is designed as a management area where offices of professionals working in the surgery centre and in the "Nuove Patologie" pavilion are located. In addition to secretariats and a large meeting room, there is a classroom of about 75 m<sup>2</sup> for the educational and training activities. On the third floor there is an additional operating theatre, with six operating rooms spread over an identical layout to the one on the second floor.

In the western half-plane houses an important area for ICU with 22 beds, which is optimally connected with both the ER and the surgical areas. A waiting zone adjacent to the reception, a doctor-relative conversation area and a dedicated environment for visitors to leave their personal belongings are located at the entrance to this area. The beds are distributed in two large stay areas with natural lighting, one of 175m<sup>2</sup> with eight beds and another of 260m<sup>2</sup> with 13 beds. There is also a room for isolated patients equipped with an anteroom and a sink. In the area with 13 beds, four beds are dedicated to chronic patients.

All beds are equipped with wall-mounted bed head units with sliding carts for the monitoring equipment and infusion therapy, which allow easy patient care. The operational rooms serving ICU are located all over the floor and both stay areas are close to all deposits, as required by accreditation.

The fourth floor is entirely occupied by the technological facilities, in particular airhandling unit and extractors serving the below levels, which are necessary for the functioning of the centre. The facility design has enhanced the energy saving, by introducing ventilated walls and innovative systems for recovering heat loss during the air refreshing.

#### Conclusion

The development of this new surgery centre has merged relief and research/education activities in seven buildings, while keeping consistent with the departmental structure of the hospital. The new design successfully promotes inter-disciplinary integration of the care pathway and even greater management efficiency.

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**Figure 1.** The north facade of the Surgery and Emergency Centre: it shows the access path of ambulances to the entry vestibule of the Emergency Room from Via Albertoni through a reserved lane.

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