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The use of Fujifilm's Synapse 3D solution

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Prof. Giulia Veronesi, director of the strategic program of Robotic Thoracic Surgery at the IRCCS San Raffaele Hospital, in synergy with the Operative Unit of Thoracic Surgery and associate professor at the Vita-Salute San Raffaele University of Milan, together with employees of the Division, tells us about the use of Fujifilm's Synapse 3D solution in the daily fight against lung cancer, still the leading cause of death from cancer today.

"My team uses Synapse 3D in the preoperative phase to perform the three-dimensional reconstruction of the lung, of the segments and of the nodule, especially in cases of small nodules that require a segmentectomy, then a sublobar lung resection with sparing of the lobe and in general for the one better surgical planning of the intervention.

Starting from the images of the radiological PACS, the three-dimensional reconstruction performed with Synapse 3D allows us to identify the effective distance between the nodule and the segmental plane, essentially the free margin of lung resection, a very important oncological criterion in targeted lung resections. In fact, if we verify that the margin is limited, we can change strategy and perform a bisegmentectomy or even a simple lobectomy.

Synapse 3D is also used to study and analyze segmental structures, which are usually quite standardized but which, in some cases, can exhibit some variability. Synapse 3D allows you to see the structures in relation to the nodule, highlighting the vein and bronchus of the segment, thus facilitating the isolation and sectioning of these structures in the surgical phase.

The three-dimensional reconstruction allows us to have more adequate margins and therefore to have substantially a better oncological radicality, with the possibility of saving healthy lung tissue. After all, segmentectomies are becoming the standard of care for lung cancer under 2 cm, while until today in solid nodules the standard was still lobectomy, today considered an over treatment of the patient as it requires the removal of a large part of the lung. for even a very small lump. Anatomic segmentectomy has already been applied for



several years with more selective criteria in patients with limited lung function or for patients already operated on the lung. Our team described robotic segmentectomy as early as 2012 and since then it has become the most common procedure in thoracic surgery, especially in light of the spread of lung cancer screening programs which fortunately are developing in Italy and abroad. Thanks to low-dose CT screening in smokers, we increasingly find cases of early stage lung cancer, with a diameter below 2 cm in most patients. The average diameter of the nodules detected during the screening phase, in fact, is equal to 1.5 cm, therefore in full indication of the aforementioned procedure. Lung screening is not yet officially a standard and is not included in the LEA (Essential Levels of Assistance) but there are Italian and ministerial pilot projects, of which two are already underway and the third, wider, is in the phase of development and is intended to cover a wider segment of the population.

It should also be considered that cases with multiple nodules are increasingly frequent, which therefore involve bisegmentectomies. The fact of being able to act at the segment level and not at the entire lobe level allows to operate in a targeted and timely manner, saving non-tumor tissue and consequently benefiting the patient from a functional and aesthetic point of view.

The practice of segmentectomy is not entirely new but initially it was substantially limited to patients with respiratory insufficiency or with problems in general of serious comorbidities, therefore in already precarious general conditions of the lung, which did not predispose him to lobectomy operations. Over time, this technique has been improved and therefore introduced in the treatment of some types of nodules, especially those that are not solid,



slower growing and usually have a better prognosis. For these cases, the indication for segmentectomy has been included in the official guidelines of the European Societies for at least 6/7 years.

Recently, some randomized studies have allowed to validate the segmentectomy lung resection procedure with tissue saving even for solid tumors in healthy subjects. The two randomized studies, American and Japanese, have provided us with the necessary evidence to change the standard of treatment today, in fact they have shown that the survival of patients undergoing segmentectomy or lobectomy, in the case of a nodule of less than 2 cm, is comparable. Even in the Japanese study, segmentectomy was correlated with a higher survival than lobectomy, safeguarding the patient's respiratory function and recovery. Among other things, it should be considered that, unfortunately, about 16% of the operated patients then, over the course of their life, have another lung tumor and the appearance of other nodules and precisely in such cases, thanks to segmentectomy, it is possible to recover. operate on the patient having a larger and more resistant residual lung. In centers specialized in videothoracoscopic surgery with large volumes of patients, segmentectomy procedures are performed routinely for small nodules found during screening. however, some types of more difficult segments require a long learning curve and the risks of complications such as air leaks are not negligible. Thanks to the introduction of the robotic technique, many technical limitations of manual video thoracoscopy have been overcome. The robotic technique has introduced important technical improvements that make the typical segmentectomy procedure simpler and safer to perform with minimally invasive technique even in centers with



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less experience in thoracoscopic, offering the procedure with minimally invasive technique instead of classic thoracotomy. The speeding up of the learning curve is another advantage of the robotic system. We keep in mind, among other things, that there are simple segments of the lung and other more complex ones: simple segments are, for example, the lingula, the lower apical

segments are, for example, the lingula, the lower apical segment, the basal pyramid, all of which are segments where there is only one intersegmental plane. The more complex segments, on the other hand, are those between two segments, in which it is necessary to make two different segmental fissures. In the latter cases, roboticfree thoracoscopy is complex and little used, while thanks to robotics the minimally invasive technique becomes applicable to most patients.Synapse 3D is an easy tool, most of the operations are automated. Once the nodule has been selected on the CT images, the software is required to isolate the segment to which it belongs, a simple and intuitive procedure. Learning to use is quick. The automatisms are immediate when the CT scan is performed following the minimum necessary parameters, in terms of thickness of the CT slices and the use of contrast, the operator's support, in this case the thoracic surgeon, can be used to complete the analysis and reconstruction in semiautomatic mode.

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A big step forward would be to simplify the reconstruction even in the presence of CT imaging studies that do not adhere to standard parameters, perhaps using artificial intelligence with deep learning protocols. After all, Artificial Intelligence techniques will also be increasingly necessary in the context of screening when it is extended, as we hope, to a very large population.

Finally, we find that Synapse 3D is also very useful for the learning of segmental anatomy by specialists, much more than paper volumes or anatomical models, as it provides dynamic and non-static images."



