



Guidelines for the Management of Paediatric Patients in Emergency and Elective setting in COVID-19 Health emergency

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1. Differentiated Treatment Pathways

At the present time, only a very small proportion of the population has been swabbed, so we have to assume that many asymptomatic patients are positive, especially among children/adolescents.

Theoretically, ALL patients with respiratory symptoms, fever and/or gastrointestinal disease should be considered potentially positive and therefore suspected.

IT IS NECESSARY to establish **differentiated logistical pathways** to separate patients with suspected infection (with respiratory symptoms and/or fever or gastrointestinal pathology suggesting infection) or with a positive nasopharyngeal swab (COVID+, “contaminated” path) from patients where infection is not suspected or with a negative nasopharyngeal swab (COVID-, “clean” path), for both traditional X-Ray and urgent Ultrasound:

- where possible, Chest X-Rays (and other necessary radiological exams) for COVID+ patients must be carried out in specific separate and independent areas within Emergency Department (ED) or in the Radiology Department
- where this is not logistically possible, encourage the use of portable equipment to perform diagnostic imaging tests in dedicated examination rooms within ED;
- Ultrasound rooms must follow the same principles; they must be separate and independent, but must guarantee adequate ventilation and air recirculation
- when following the “contaminated” path (COVID+), health workers involved in carrying out the radiological tests must dress and undress in a dedicated area
- it is crucial to take into account the time required for sanitisation, once the test is completed, which must be carried out by dedicated staff trained for the purpose
- sanitisation needs to include adequate cleaning of radiological instruments, particularly the cassettes (disposable plastic protections should be used) and of the protective equipment used by parents or carers (lead aprons).

Similarly, specific pathways for accessing CT scans are required, in particular from Emergency Department (ED→CT) and from intensive or sub-intensive care units (ICU→CT) or ordinary hospitalization units.

2. Radiological exams

It is now scientific proof that the nasopharyngeal swab is currently the most effective way to diagnose COVID-19 infection.

Chest X-Ray is not essential for the diagnosis, but, although not offering highly specific findings, it remains the first examination to be carried out in paediatric patients because it allows to exclude other possible causes of respiratory disease with interstitial pattern different from COVID-19.



Only an AP image (supine) or PA image (standing) is required; a lateral projection is not needed for diagnosis of interstitial pattern and neither does it provide information that would help with treatment, but sometimes could be performed only at the explicit request of the radiologist.

X-Rays performed at patient's bed represent a good diagnostic tool for evolutionary monitoring of pneumonia.

Chest CT scan must be reserved to selected paediatric patients. It is indicated for hospitalised patients (whether in intensive care or not) who are non-responsive or who are worsening despite treatment. For patients accessing via ED with **moderate or severe** respiratory symptoms, but clinically stable, after the nasopharyngeal swab the first test needs to be Chest X-Rays.

If the swab is positive and X-Ray is highly suggestive for COVID infection (although the low specificity and the high underestimation rates of pulmonary parenchymal involvement), a CT scan can be indicated, to determine, together with clinical and laboratory findings, possible hospitalization in Intensive Care Unit.

Chest CT scan, in the absence of other indications, needs to be conducted **without contrast medium**, since interstitial pattern is the principal radiological expressions of the infection.

The use of automatic dose reduction systems, always desirable in pediatric patients, should be managed differently in this specific group of patients.

Generally it is advisable to identify two performing modalities:

Group 1. Volumetric acquisition with high spatial frequency reconstruction algorithm for pulmonary parenchyma in younger patients, particularly within the first year of life, with limitation or, when not possible in relation to available software, deactivation of different automatic exposure control systems (>ultra low dose). This can avoid both reduced diagnostic CT exams for the evaluation of pulmonary interstitial pattern and a significantly increase in dose exposure, due to the anatomical morphological characteristics of these kind of patients.

Group 2. HRCT volumetric acquisition in older patients (above 15-20 kg) as already described (<https://www.sirm.org/wp-content/uploads/2020/03/Tecniche-esecuzione-HRCT-in-pazienti-COVID-19.pdf>).

We propose certain reference technical parameters for **low dose** CT scanning, agreeing with European Diagnostic Reference Levels for children:

a. General HRCT low dose parameters (Group 2)

| | |
|------------------------|----------------------|
| Kv | 80 - 100 |
| mAs | 30 (fixed parameter) |
| Thickness | 1 mm |
| Recon increment | 0,7 – 1 |
| Pitch | > 1 |

Table a. Basic reference framework for HRCT on children (more 15-20 kg in weight), to be adjusted to the equipment available and the weight of the patient.



b. European Diagnostic Reference Levels for chest CTs in children

| Weight group | CTDI _{vol} mGy (media) | CTDI _{vol} mGy (mediana) | DLP, mGy cm |
|--------------|------------------------------------|--------------------------------------|----------------|
| <5 kg | 2,4 | 1,4 | 35 |
| 5-<15 kg | 1,7 | 1,8 | 50 |
| 15-<30 kg | 3,1 | 2,7 | 70 |
| 30-<50 kg | 4,5 | 3,7 | 115 |
| 50-<80 kg | 5,6 | 5,4 | 200 |

Table b. Taken from: Radiation Protection - European Guidelines on Diagnostic Reference Levels for Paediatric Imaging N° 185 ISBN 978-92-79-86304-2. Pr. MJ-02-18-775-EN-C. Measured on a 32 cm dummy.

Pulmonary ultrasound (POCUS – Point of Care Ultrasound), performed in intensive care unit in the patient's bed, can also be a monitoring tool to assess the effectiveness of prone-supination manoeuvres. In this field, POCUS systematic application may reduce the need for diagnostic imaging tests, reducing the amount of exposed personnel to the risk of contagion and helping to optimize therapies, especially in critical patients.

3. X-Ray examination requests

During this period of national emergency and according to various laws and regional ordinances, all **outpatient clinics** are suspended, including external pre-booked and day hospital tests.

The only **requests that can be fulfilled** are those marked Urgent (U) or Brief (B), within the timescales laid down by law. All requests that can wait at least a month for a response are to be postponed; in other cases the requesting specialist or paediatrician needs to explain the urgency to the radiologist, and this latter will assess the situation accordingly.

Abdominal ultrasound, in accordance with the indications of the SIRM-SIUMB-FISM multi-organisation document, has no evidence of usefulness and is not recommended for COVID+ patients, since symptoms are mainly respiratory. Similarly, Ultrasound examination of other parts of the body (such as Doppler, soft tissues, superficial organs) is of no clinical benefit.

Urgent X-Ray requests (covered by conventions/agreements with paediatricians in the field that vary from region to region) to investigate respiratory symptoms are not to be carried out on external patients, who should be sent to TRIAGE in ED.

4. Trauma

Precautions need to be taken with regard to children entering ED with **polytrauma**, as it is often impossible to obtain an adequate medical history (for example, absence of parents if involved in the same accident/traumatic event) or to differentiate clinical symptoms, particularly those of respiratory nature (whether they are due to the trauma or not). In these specific cases, if the patient requires a radiological test (X-Ray, Ultrasound or CT), the “dirty” path for COVID+ patients anyway must be followed.

Conversely, in **trauma of low or medium severity**, the COVID- pathway is to be followed if there are no respiratory symptoms or fever associate. If these patients has such



symptoms or history or close contact with adult patients COVID+, they must be addressed to COVID + path.

5. PPE

In paediatric radiography the same **general rules** for the safety of patients and staff with regards to using personal protective equipment in a hospital setting apply, and need to be applied, even if not necessarily in a uniform manner, as per the two pathways highlighted above in all hospitals nationally.

In general terms on entering the department the young patient and their carer (one per child) must put on a **protective mask** (surgical or similar); given the limited supply of these within the health service, patients are asked to use their own. Medical facilities are to advise patients of this via information campaigns. Radiologists, and health workers in general, must also adhere to directives concerning clothing, namely by wearing uniform (white) and wearing surgical masks and gloves, whether their contact with patients is direct or indirect.