Respiratory failure - A new treatment

Authors:

*prof. Daniele **RAGGI***
Degree in Sport Science, Physiotherapist, Posturologist, Mézières practitioner.
Lecturer in Posturology c/o School of Medicine (Department of Experimental Medicine and Pathology), Università "La Sapienza" in Rome and c/o School of Sport Science, Università Cattolica in Milan. Director of Posturalmed (Posturology studio) in Milan.

*Monica **CAPIETTI***
Occupational Doctor, Degree in Medicine c/o Università degli Studi in Milan, specialized in Occupational Medicine c/o Università degli Studi in Pavia.

Observing people suffering from "lack of air", it is typical to see them doing their utmost to take all the air they can, no matter if they suffer from emphysema, asthma or respiratory failure. Even athletes when they finish a race, exhausted, use momentarily attitudes that are typical of these conditions.
Lack of air is a dramatic feeling: it recalls immediately the end of life. Any difficult inspiration needs to collect as more air as one can to provide for the shortage and the limited functionality of the lungs.
It is inevitable, since it is instinctive, that people with such difficulties concentrate their efforts in the inspiration phase, but no one ever thinks of concentrating on the expiration. The same happens to beginner swimmers, who always focus on taking air and not on letting it go, instead. By doing this, they soon feel as if they were suffocating having no air, even if their lungs are full. It is a survival mechanism telling them they cannot take anymore air in if they do not release what they already have in their lungs first. The sensation is exactly the same as respiratory failure.

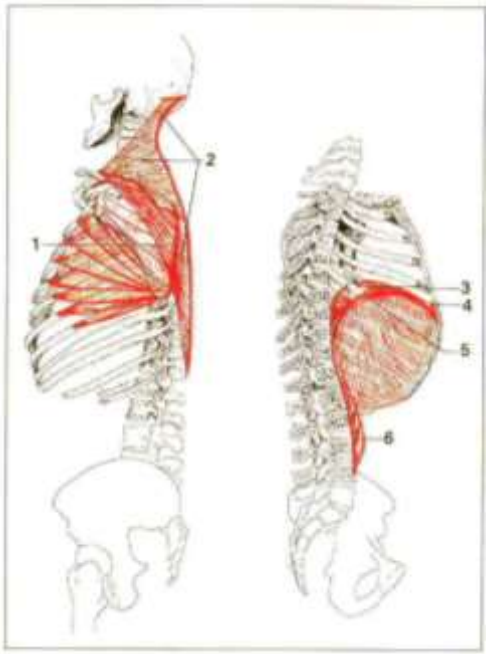

Fig.1 Thorax and diaphragm muscles: insertion lines.
1. Serratus anterior;
2. Trapezium;
3. Central tendon of the diaphragm;
4. Sternal part of the diaphragm;
5. Diaphragm;

Let's make an example to understand this mechanism. Imagine you have a glass full of black water that we will compare to lungs during the expiration phase, i.e. when they are full of carbon dioxide. Now imagine you empty 1/3 of the glass and refill it with clean water, i.e. oxygenated air. It is easy to understand which will be the color of the water at this point, as well as the importance of the value and the quality of the gases which are present in the lungs in case of a partial expiration. Imagine you empty 2/3 of the glass and to refill it with clean water. It is easy to understand that the color of that

water will be clearer and more limpid than the first one.

The same happens to the air inside the lungs when expiration is correct and complete.

Structural modifications

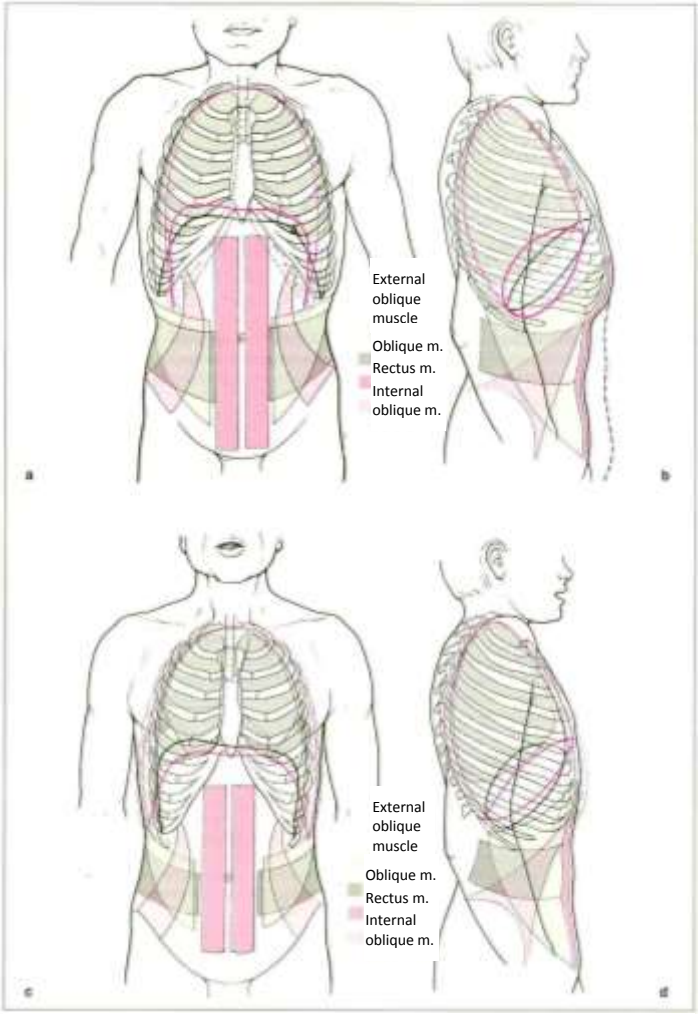

Fig.2 Thoracoabdominal excursions during inhaling (a, b) and exhalation (c, d) in anterior and lateral projections of the thorax. During inhalation, the tension of abdominal muscles and of the vertical formations of mediastinum reduces, while tension at diaphragm level increases. The contrary happens during exhalation. The vertical stretching of the lungs downwards and upwards leads to a lowering of the intestine and therefore to an advance of abdominal wall (see dotted lines).
(V. Pirola, Cinesiologia, Ed. Ermes)

Let's now look at a case of emphysema and try to understand what has changed over the years in this thorax structure and why.

Due to an innate mechanism of survival, in case of difficulties in life, tensions, fear, or pain, people tend to react by inspiring, taking air and keeping it. No one in these cases would breathe out relaxed.

Looking at diaphragm, the main muscle involved in breathing, it is clear that it works like any other muscle of the body, following laws of statics and dynamics. Its fibers contract in case of nervous stimulus and deconstruct at the end of it. Moreover, it is not able to stretch and go back to its ideal relaxed position autonomously. It is more likely for a diaphragm to be tense and contracted than relaxed and deconstructed, because of all the physical, mental and emotional stress we go through during life. Over the years, this mechanism will lead the muscle to lose its elasticity and length and to become therefore shorter. In other words, the connective tissue will tend to fix the fibers in a shorter position than the functional one. When this happens, the diaphragm tends to lower itself and to lose its ability to rise again and to expel air in a proper way. It is in this moment when the patient suffering from respiratory failure, feeling the lack of air since he is not able to empty the lungs anymore, will inevitably try to breath in as much air as possible. Thanks to joint physiology, it is clear today that because of diaphragm action first and of the accessory muscles of breathing then, the ribs and the thorax lift themselves in order to open and let more air in (Fig.2-3).

Accessory muscles follow the same laws for retractions, so they will become shorter and shorter, preventing the thorax from lower itself. This situation will cause in the same way respiratory failure, i.e. lack of air for which the patient will increase the "deficiency" by trying to expand an already expanded thorax. Since the thorax will be limited in its opening by ribs and vertebral joints and by the contact between the collarbone and the first ribs, it will be impossible for it to lift itself. That is how a barrel-shaped chest develops.

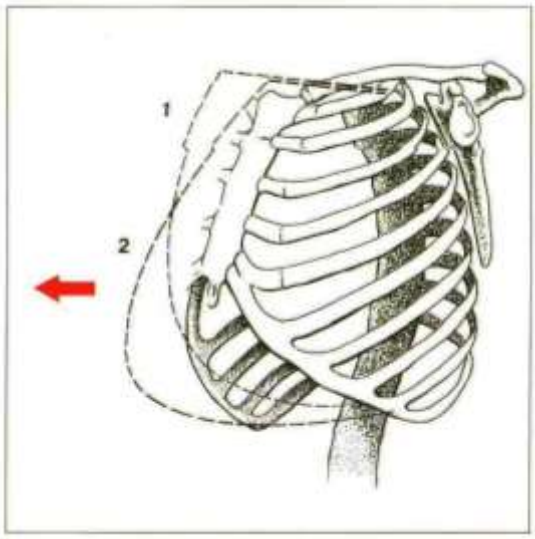

Fig.3 Two different interpretations of the thoracic expansion (in particular, at sternum level): dotted line 1 according to Kapandji, dotted line 2 according to Forni and Cappellini.

(V. Pirola, Cinesiologia, Ed. Ermes)

Accessory muscles of breathing

Another important element is composed by the accessory muscles of breathing and their origin (Chart 1-2); any accessory muscle having a primary role (i.e. not accessory) will inevitably suffer from and cause problems. The accessory muscles originating in the neck will, for instance, disturb the cervical zone, the accessory muscles originating in the shoulder blade will cause problems of blocks and stiffness in the shoulders, and those of dorsal origin will bring about reductions and problems at the spine.

Chart 1 Inspiratory muscles

MAIN	SECONDARY
✓Diaphragm	✓Sternocleidomastoid
✓External intercostal m.	✓Elevator of ribs
✓Scalene	✓Serratus posterior sup.
	✓Pectoralis minor
	✓Pectoralis major
	✓Serratus anterior
	✓Latissimus dorsi
	✓Subclavius
	✓Trapezius
	✓Elevator of scapula
	✓Erectospinae m.

Chart 2 Expiratory muscles

MAIN	SECONDARY
✓Internal intercostal m.	✓ Quadratus lumborum
✓Abdominal m.	✓ Transversus thoracic
	✓ Subcostales m.
	✓ Serratus posterior inf.

Other problems

In a patient suffering from respiratory failure, when the diaphragm lowers itself in an inadequate way, many of the organic and mechanic functions are altered.

It is the case of digestive problems due to excessive compression of the diaphragm on the stomach, and of hiatus hernia due to excessive traction of diaphragm on esophagus. The intestine is excessively compressed and this condition often provokes abdominal congestions. Female genitals and the urinary bladder are consequently often disturbed as well.

Also venous return from inferior limbs is affected by an excessive abdominal tension and the same process affects the lymphatic system, which loses the chance of exploiting an action of pressure and depression from the diaphragm on the cisterna chyli). Being connected to the diaphragm through the pericardium ligaments, also heart is dragged down and its delicate functions result therefore disturbed.

The lumbar area, where the powerful pillars of diaphragm insert themselves, often suffers from painful hyperlordosis because of an exaggerated inwards traction. As a consequence of an initial lumbar postural imbalance, the entire posture gets inevitably altered.

Therapeutic opportunities

Fig.4 The position imposed by the tool commits the posterior muscular chain and forces the respiratory muscles of the back to stretch. It is useful to help the patient emptying the thorax if it is blocked in inspiration.

There are a lot of therapeutic opportunities for the subject suffering from respiratory failure. It is necessary to have a general overview of the patients, not just considering their respiratory condition. It is crucial to act in a global way and not to strengthen their respiratory system, instead, as it is often done. The therapist must know all the above-mentioned mechanics and the modalities to give the patients the chance to empty a blocked thorax so that it regains the possibility of being regularly filled. There are powerful techniques to unblock the diaphragm, which can give relief to the patients and at the same time also improve all the posture and structure.

Exercises of global non-compensated muscular stretching

To intervene on respiratory failure and postural alterations it is necessary to carry out a global action involving the muscular chains. The tool used to do that is notably useful, since it allows the therapist to eliminate the compensations the body uses to escape from any attempt of muscular stretching. In these cases it is categorical to restructure the old posture by improving tissues elasticity, in order to make the whole structure more flexible, harmonious and functional (Fig.4-5).

Fig.5 Hands pressure on patient's chest made by the therapist to favor the emptying of the thorax and stretch neck muscles.

For more information on the Raggi Method®- Pancafit® please address to
Posturalmed S.A.
Tel. +39 0239257427 or +39 0239265686
- Fax +39 0239200420
Email: corsi@posturalmed.com
Website: www.posturalmed.com