Dear Reader,

There are many new and promising treatments on the horizon for children with chronic lung diseases. But, in looking to the future, let’s not forget the tried-and-true treatments of the past and present. One such treatment is Chest Physiotherapy, or Chest PT. It’s not expensive, nor is it fancy, but it works. Chest PT promotes wellness and recovery from sickness.

The pages that follow describe simply and clearly the technique of Chest PT. Learn it, apply it, and you will be well on your way to providing the best care possible for yourself or your loved one.

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INTRODUCTION
The doctor has decided that Chest PT now needs to be a part of the daily routine at home. Upon learning this, many families are filled with questions, concerns, and doubts. "What exactly is that and how in the world is it done?" Hopefully, there will be a teacher ready to answer questions. Once the teacher leaves, however, old questions may now be replaced by new ones. "How can all of this possibly be remembered and done right?" This manual was written just for that reason. It's a "where-do-I-go-from-here" booklet that may be just the "string-around-your-finger" type of reminder that is needed. Remember: the doctor’s staff is always ready to answer questions. That's what they are there for and they don’t mind helping. After all, how will you ever learn unless you ask, ask, ask?!

The Lungs
The respiratory system can be divided into three main parts:

1. The Upper Respiratory Tract – includes the mouth, the nose, and the sinuses. The upper respiratory tract warms and adds moisture to (or humidifies) the air we breathe. It also filters out particles like dust, smoke, and germs.

2. The Lower Respiratory Tract – includes the airways and the lungs. The lungs are large organs in the chest that stretch from the collarbone (clavicle) to the bottom of the ribs. The lower respiratory tract begins with the main windpipe, or trachea. The trachea divides into two main breathing tubes, or mainstem bronchi (bronchi is plural for bronchus). The left mainstem bronchus connects the left lung to the trachea and the right mainstem bronchus connects the right lung to the trachea. Each mainstem bronchus branches out into small bronchial tubes (or bronchi) that spread throughout each lung like branches of a tree. The smallest branches are called bronchioles. Just as the smallest branches of a tree end in leaves, the small bronchioles of the lungs end in tiny air sacs, or alveoli (alveoli is plural for alveolus). Each alveolus is surrounded by tiny blood vessels or capillaries. Gas exchange takes place as alveoli inflate and deflate like tiny balloons with every breath against the blood-filled capillaries.

3. The Respiratory Muscles – include the diaphragm and other breathing muscles that are responsible for the pumping action that draws air into and pushes air out of the lungs. The respiratory muscles make breathing possible. The diaphragm is the major breathing muscle. It is dome-shaped and runs beneath the lungs to separate the stomach and abdomen from the chest. The muscles that run in between each rib are called intercostals. There are other minor muscles in the neck and back that help with breathing. When we breathe in (also called inhaling or inspir- ing), the diaphragm moves downward toward the feet. This causes air to rush into the lungs. When we breathe out (also called exhaling or expir- ing), the diaphragm relaxes back into its normal position, causing air to be pushed out of the lungs.

The main goal of the respiratory system is to allow gas exchange to occur. There are two important parts to gas exchange which are crucial for life:

A. Oxygen (O2) Exchange – When we breathe in, oxygen from the air travels through the respiratory system and dissolves into the blood where it is carried to all parts of the body.

B. Carbon Dioxide (CO2) Exchange – The cells in the body need oxygen and food for energy. They make carbon dioxide as a waste product. This process is called metabolism. Too much carbon dioxide can poison the body. Carbon dioxide leaves the body by dissolving from the blood into the respiratory system, where it is breathed out.
Although the upper respiratory tract does a good job filtering out particles in the air we breathe, some particles might get through and find their way into the lower respiratory tract. If allowed to stay there, these particles would clog the small bronchioles. This would allow germs to multiply and cause lung infections.

There are glands in the airways that help remove the particles in the respiratory tract. These are called exocrine glands. Exocrine glands make a thin slippery layer of mucus (also called secretions, sputum, or phlegm) that lines the airways and traps these particles.

Beneath the mucus layer in the airways lies tiny hair-like structures called cilia. Cilia look like tiny hairs that move in rhythm, pushing the mucus and trapped particles toward the throat. Smoking or not drinking enough water can decrease their ability to do this. Once in the throat, the mucus and trapped particles are coughed up or swallowed.

The process of breathing is controlled by the brain. The brain knows how much oxygen needs to be inhaled and how much carbon dioxide needs to be exhaled. The breathing control center of the brain is in the brain stem, which is found at the base of the brain. The brain stem controls how fast and deep breathing is by sending signals through the nerves to the respiratory muscles. The brain does this by measuring how much carbon dioxide is in the blood around the brain stem. If the amount of carbon dioxide is high, more can be exhaled by faster and deeper breathing. If the amount of carbon dioxide is low, less can be exhaled by slower and more shallow breathing. By controlling breathing, the brain stem can keep a normal amount of carbon dioxide in the blood.

It is sometimes important to know how well the lungs are inhaling oxygen and exhaling carbon dioxide. Looking at the blood can show what is happening in the lungs. An Arterial Blood Gas (ABG) test measures the amount of oxygen and carbon dioxide in a sample of blood drawn from an artery. The results of this test tell the medical staff not only how well the lungs are breathing but also how to help the lungs if they are not breathing as well as they should.

To review, oxygen breathed in from the air enters the upper airway through the mouth and nose. It flows into the back of the throat and through the voice box (or larynx) into the trachea. Once in the trachea, the air flows into the left and right mainstem bronchus and continues flowing through the bronchi as they become smaller, branching deeper into the lungs. Finally, the air reaches the alveoli where it dissolves into the capillaries. The blood in the capillaries takes the oxygen to all parts of the body. This blood also brings carbon dioxide back from the body to the respiratory system. The carbon dioxide dissolves from the capillary blood into the alveoli where it travels back through the branching bronchi toward the mainstem bronchi. From the mainstem bronchi, the carbon dioxide enters the trachea, passes through the larynx, and is breathed out through the mouth and nose.

To simplify the process even further:

1. Oxygen is inhaled into the lungs.
2. Oxygen travels from the lungs into the blood.
3. Oxygen travels in the blood to all cells of the body.
4. Oxygen enters the cells.
5. Metabolism takes place.
6. Carbon dioxide leaves the cells and enters the blood.
7. Carbon dioxide travels in the blood back to the lungs.
8. Carbon dioxide enters the lungs.
9. Carbon dioxide is exhaled from the lungs.

CHEST PT: “WHAT EXACTLY IS IT?”

Chest PT (also called CPT) stands for Chest Physiotherapy. It is a special clapping technique performed by the hands to loosen the mucus in the lungs. Once the mucus is loosened, gravity can help it drain toward the mouth using certain body positions (also called postural drainage). The clapping and the body positions are done together to give the best treatment. Chest PT is a very important treatment, well worth the commitment it takes to do it well and do it regularly. If it is done wrong, it may not work. If it is done right, it can help sick people get as well as possible and keep them that way.
CHEST PT: "HOW IN THE WORLD IS IT DONE?"

First, get into a comfortable position, and cup your hand. While it will be natural to keep the wrist stiff, it should really be relaxed, yet controlled. It will take practice to do this, but a relaxed yet controlled wrist makes the treatment more effective and the person giving the treatment more comfortable. At first, the arms, shoulders, and back may feel tired. Soon, however, the muscle strength will be developed to do a whole treatment without needing a rest. Just keep at it!

Next, concentrate on the clapping technique. Keeping the hand cupped, practice by “clapping” over the top of the thigh. Don’t slap – CLAP! Try to make a hollow, “popping” sound instead of a flat, slapping sound. The popping sound is what you really want to hear. Slapping will turn the skin much redder than clapping. Red skin is a “red flag” that suggests the need for more practice.

Clapping with a cupped hand causes a hollow, popping sound against the skin. That sound wave travels through the chest wall into the lung tissue. Although the clapping should be as hard as possible, what loosens the mucus is the sound wave created, not the strength of the clapping.

On a small child, clapping over and over with one hand may be best. On a larger child or adult, both hands can be quickly used, one right after the other. For this reason, right-handed people should not ignore the left hand. Practice until both hands are equally comfortable.

Now, concentrate on the body positions and exactly where the clapping should be done. Imagine the rib cage, or chest, being divided into three equal parts. The upper area would stretch from the top of the armpit in front, over the top of the shoulder, to the top of the armpit in back. The middle area would span the breast area in front and the opposite area in back, and up underneath the armpits on each side. The lower area would cover just below the breast area to the bottom of the last rib on the front, back, and sides.

Begin with the upper area. With the child sitting up and leaning slightly back, clap over both sides of the upper front area first. Point the heel of your hand toward the armpit and run the side of your hand along the edge of the collarbone. This might be the most comfortable hand position for that area but if another position works better, that’s fine. Just make sure that both the left and right sides of the upper front area are covered. Move the hand around if needed. With an infant, it may be better to use one hand to cover both sides of the upper front area at the same time rather than doing each side separately.
To cover the upper back area, have the child sit up and lean slightly forward. Clap over both the left and right sides of the upper back area. Face the child’s back and clap over the shoulder blades, allowing your fingers to curl over the shoulder, if needed. As before, this is only an option. There may be other hand positions that work better. Once again, it may take only one hand to cover both the left and right sides of the upper back area on an infant.

Spend 2-3 minutes clapping with each body position. One nice thing about the upper areas is that both the left and right sides can be done at the same time. This shortens the treatment time a little.

Next, concentrate on the middle areas. Begin by having the child lie flat on his or her right side, draping the left arm over the head. Clap just underneath the arm-pit on the left side.
Now have the child lie flat on his or her back. On a male, clap directly over the breast area on both the left and right sides. On a young female you may do the same. As breast development begins, she may be tender there and the clapping may need to be limited to just above the nipple area and not directly on top of the breast. This same rule applies to an adult female, because the fat tissue in the breast will block the sound wave created by the clapping and the treatment will be less effective.

Following this, place the child flat on his or her left side with the right arm draped over the head. Clap just underneath the armpit on the right side.
Lastly, have the child lie flat on his or her tummy and clap over the middle area of the back on both the left and right sides. If possible, do not clap over the breastbone or backbone. Clap only over the areas that are covered by ribs.

The treatment is almost done!

To begin the last part, have the child once again lie on the right side. This time, prop the hips up, maybe with a couple of large pillows. The higher the hips, the better (to a point!), but always make sure that the child can breathe comfortably. If breathing becomes hard, lower the hips a little. With the left arm draped over the head, clap over the lower part of the ribs, down to the last rib, on the left side.
Next, roll the child onto his or her back, keeping the hips propped up, and clap over the lower parts of the rib cage on both the left and right sides. Keep in mind that the rib cage angles upward toward the center in the front. Here, angle the hands as well, so as to keep the clapping over the ribs.

Clapping over areas that are not covered by ribs could hurt the child or make him or her very uncomfortable. Since there isn’t any lung tissue there, time will be wasted.

Now, have the child lie on his or her left side with the right arm draped over the head. Once again, keep the hips propped up to maintain a large angle. Clap over the lower part of the ribs, down to the last rib, on the right side.
Finally, place the child on his or her tummy, keeping the hips propped up. Clap over the lower part of the rib cage on the back, on both the left and right sides.

THAT’S “HOW IN THE WORLD” CHEST PT IS DONE!

With 2-3 minutes spent on every body position, the treatment should last about 20-30 minutes, not counting the time it takes to get into each position. Beginners should keep their eyes on a clock until comfortable with what 20-30 minutes feels like. Be careful not to cheat on the time!

The doctor will tell you how often to perform the treatments. It is best to do them before a meal, but if this is not possible, wait at least one hour after a meal before starting. On a full stomach, Chest PT and coughing can cause nausea and vomiting, which can lead to choking. Don’t do Chest PT any less than the doctor orders; however, it’s fine to do the treatments more often, if necessary. Anytime it becomes necessary to do Chest PT more often, let the doctor know.

RESPIRATORY ASSESSMENT: “IS EVERYTHING OK?”

Older children and adults can easily tell when it’s harder to breathe than usual. For an adult giving this treatment to a young child or infant, however, the signs may not be as clear. The most important rule to remember when doing Chest PT is to always keep one eye on what is being done and the other eye on the person getting the treatment. Flaring nostrils, an increase in breathing or heart rate, sweating, blue-ness of the skin around the eyes or mouth, or a sinking in of the skin between the ribs with every breath are all signs the child is having to work too hard to breathe and needs help. If this should happen, stop the treatment and have the child sit up. If the child begins to feel better and these signs disappear, carefully begin the treatment again.

If it becomes hard to breathe in the hips up/head down position, try lowering the hips a little. These signs may also appear if the treatment has been started too soon after a meal. If the child is sick and more congested than usual, or if the treatment loosens a lot of mucus, he or she may need several short rests during the treatment. Stop whenever necessary for the child to cough or be suctioned. The goal is to help clear the mucus without having the child feel as if he or she is drowning in the process!

If at any time the above signs do not quickly disappear, call the doctors right away. If you are not sure, call anyway! It is always better to be safe than sorry.
HELPFUL HINTS

For those giving treatments to young children, here are a few suggestions that might help make it easier and more enjoyable:

Chest PT can be done on the floor, the couch, a bed, or someone's lap. There might be other places that work even better than those listed here. Try them all, and find out which place seems to work best. Approaching the child from different heights (above or on the same level with the child) or different angles (at the feet, head, or either side) will help in deciding what gives the best treatment. Make sure that an infant feels safe and secure by firmly supporting the head and body so that the baby does not bounce around more than needed. Because an infant can't say that a treatment is too rough, he or she must be carefully watched. Get to know the difference between an “I’m not in a good mood” cry and a “That hurts me” cry. Once a child is used to it, Chest PT can be relaxing and enjoyable. Try to fit Chest PT into the day’s normal routine so as not to interrupt sleeping and eating.

If providing therapy for a young child, cooperation may be difficult. Not many little kids care to sit still for Chest PT when the world is full of so many more exciting things to do! However, there is a lot that can be done to help make it fun and to motivate cooperation.

Many children enjoy the individual attention that Chest PT enables them to get from a willing adult. Try making it a time to share thoughts and feelings. It is also a good time to read special books together or watch a favorite TV show. Some families make it a rule that a favorite daily program cannot be watched unless the child gets Chest PT before or during the show!

One mother helped her child decorate Chest PT bags to hold special quiet toys the child saw only during Chest PT. The bags were rotated each day. Be aware that some children like to have their friends involved while others prefer privacy.

Another parent had his child collect pebbles and store them in a decorated Chest PT jar. Every time the child cooperated with Chest PT, a pebble from the jar was awarded. When a certain number had been collected, the child got to choose what the family did together one night (go for a walk, play in the park, watch a special TV show, etc.). The nice thing about this plan was that there was no money involved.

Chest PT should be thought of as a normal part of the daily routine, as important as brushing teeth and eating lunch. The commitment to doing Chest PT well and on a regular basis is a commitment to making the most of life. It is worth the effort!

Be creative! It is hard for kids to come in from playing outside on a beautiful spring day. Chest PT can be done outside. For the head down/hips up position, try sitting upside down in a lounge chair, using a bean bag, or lying head-first down a slide. Above all, get comfortable. Encourage activity and exercise. Praise effective coughing and deep breathing. Make Chest PT fun by including play in the treatment time. Never refer to Chest PT in a negative way or use it as punishment, but do be consistent and let the child know that Chest PT must be done despite any amount or type of protest. Kids of all ages like plenty of advance notice about when Chest PT will be done. Giving them some control over where or when it is done can help.

Older kids will begin to need some independence sooner or later. Following the instructions in this booklet, they should be able to perform the treatment on their own (aside from the back areas that are too hard to reach). It is important that their first tries be well supervised, but eventually a thorough self-treatment should be possible (with someone else following up on the back areas). Just keep in mind that both parts of the treatment need to be done so that the whole treatment is finished in one sitting, if possible.
There may be reasons why doing Chest PT with the hands is too hard. If, for instance, there was no one to follow up and complete the therapy on the back area or if there were physical problems with the hands, Chest PT would not work as well. There are many devices that can help with therapy, ranging from a small, hand-held palm cup to an electric mechanical percussor with strap-on attachments. For more information about these, or any other new products or therapies, ask the doctor to refer you to someone who works with them and who can explain them more fully.

Hopefully, the information here has helped not only to improve knowledge of Chest PT but also answer some questions and concerns.

It will take time, hard work, discipline, and commitment to do Chest PT well and regularly. But just like anything else that is worthwhile in life, it will pay off. Before long, with patience and practice, you will be an expert. By prescribing this therapy at home, the doctor is showing great confidence in your abilities. Now it’s time to have confidence in yourself!

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