

Background, tips and practical examples for adequate arm positioning

Thorax/abdomen examinations of motion-impaired patients using computer tomography

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Abstract

Thorax/abdomen examinations are routine CT examinations in which the patient's arms are usually positioned above the head. However, if the patient's arms cannot be positioned above the head, correct and stable positioning are all the more important in order to avoid "photon degeneration artifacts" and not to increase the radiation exposure unnecessarily. With simple tricks and the right tools, the correct position can be reliably achieved in various situations.

Background

Thoracic/abdominal examinations are routine CT examinations during which the arms should not be positioned next to the patient under any circumstances, as this can lead to so-called "photon degeneration artifacts" and the radiation exposure can be increased unnecessarily.



Fig. 1: Schematic illustration of the enlarged body cross section

The reason for this is that the cross section of the body widens significantly when the arms are placed next to the body. The lateral diameter then becomes so large that many X-ray quanta can no longer penetrate the body in the lateral beam path and thus no longer contribute to the overall image (see Fig. 1).

Depending on the patient's posture, these artifacts can vary in severity. Especially the evaluation of the upper abdominal region (liver and spleen) is usually particularly limited by these artifacts and the reliable exclusion of splenic or liver pathologies is often impossible (see Fig. 2).

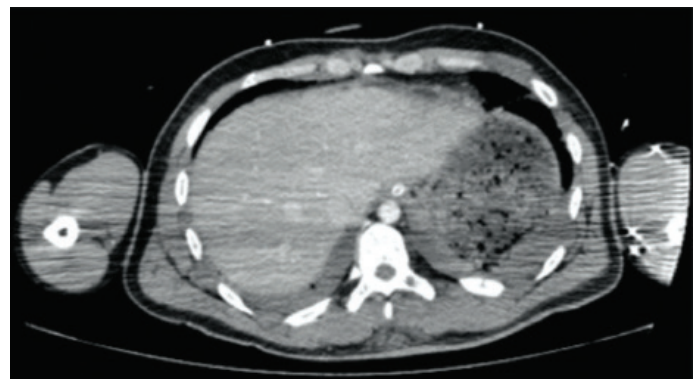


Fig. 2: Artifacts with a more difficult assessment of the upper abdominal region.

It has therefore become standard practice for patients to position their arms above their head for thorax/abdomen examinations in order to position them outside the examination area. However, it is often difficult or impossible for patients to position their arms above their head or to keep them in the desired position during the entire examination. The reasons for this are very diverse and can be found in the emergency environment (polytrauma posi-

tioning), with inpatients (e.g. patients requiring intensive care) as well as outpatients (e.g. restricted movement in the shoulder). In these situations, it has proven useful to position both arms on the abdomen.

In addition to the correct positioning of the arms, when standardizing workflows for these positioning situations, consideration should be given to ensuring that positioning can be performed easily, quickly and without complications, even in stressful situations. In addition, it is imperative to use hygienically safe positioning aids.

In the following, some tips are given for the options described above with background information and advice on adequate arm positioning for thorax/abdomen examinations.

Arms over head

It has become standard practice to have patients hold their arms above their heads during thorax/abdomen examinations. The advantage of this option is that radiation exposure and the risk of suboptimal arm position and associated artifacts can be minimized. The disadvantage of this option is that this position is not possible for all patients and may cause pain.



Fig. 3: Patient in supine position with arms over head

Most important key points for patient positioning:

- Place patient on table in supine position with thorax/abdomen as flat as possible.
- Place head and shoulders in as comfortable a position as possible on the positioning aid and raise arms above head.
- Place forearms on the highest part of the positioning aid.
- If necessary, put positioning aid underneath the legs to relieve pressure on the lumbar spine.

Measures in case of more difficult “arm-over-head” positions

If patients have difficulty taking this position, three simple measures can be helpful:

Option 1



Raise arm position by using an additional cushion (pay attention to the stability of the “tower”)

Option 2



Secure arm position using ProBelt

Option 3



Secure arm position using a sandbag

Fig. 4



In particular, securing the arm position by means of a sandbag turns out to be a very simple, quick, less restrictive and nevertheless effective alternative, provided that the positioning cushion used has a certain adaptability (in the picture: positioning aid PearlFit Wedge 56×50×25, Pearl Technology AG, Schweiz)

Arms on abdomen

The reasons why the arms are not positioned above the head can be multifaceted. In these cases, it has proven useful to position both arms on the abdomen. It is important that the arms are positioned as straight as possible with a certain distance between them on the abdomen, as this is the only way to ensure that the upper arms are high enough and artifacts can be prevented. In addition, stretching the arms ensures that the contrast medium injection can be performed without complications.

Patients with a high level of compliance usually find it easy to assume and maintain this position. However, experience has shown that patients who cannot place their arms above their head often have poor compliance or are even unconscious. Accordingly, the arms must be positioned and stabilized in this position with various positioning aids.

If a patient can only hold one arm above his head, this should be done to reduce radiation exposure. However, this case will not be discussed further here, as it is a rare exception in daily routine.

Important key points for patient positioning with arms on the abdomen:

- Place patient on table in supine position with thorax/abdomen as flat as possible and positioning head comfortably
- If necessary, put positioning aid underneath the legs to relieve pressure on the lumbar spine.

In the simplified version, the patient's arms are held in a stretched position by means of a combined solution of

distance holder and belt ("Beautiful Images Cushion", ProBelt Thorax PFC, Pearl Technology AG, Switzerland, see box).

Arm fixation Option 1: Classic

First, place the cushion on the abdomen as a distance holder and position the arms on it. Then bring the straps along the table rail into the correct position and close them tightly over the arms.

The advantage of this option is that direct fixation of the patient to the table is obtained. The disadvantage, on the other hand, is that the arms are often not reliably held in position by the straps and slip to the side of the body again, especially in the case of heavy patients. This problem can be reduced by using an adaptable yet stable cushion as a distance holder.

Arm fixation Option 2: simplified (see box)

This option has the advantage that, due to the integrated solution of distance holder and fixation, no extra steps are necessary and handling is therefore simple and quick. In addition, the arms are held in the correct position, which enables good image quality without artifacts ("Beautiful images cushion"). The only disadvantage is that the patients are not fixed to the table, although this is rarely necessary in the cases mentioned above.

Since the option with the arms on the belly with the integrated belt-cushion solution is a new approach for many, it will be illustrated below using two case examples.

Workflow Arm positioning on abdomen with ProBelt 200 Thorax PFC

Fig. 6



Place ProBelt Thorax on abdomen



Position arms straightened on positioning aid



Wrap belt around arms and close by means of hook-eyelet

Case study 1: Outpatient

Examination: CT abdomen pelvis

Patient: 89-year-old, outpatient

Limitations: Hemiparesis right arm, severe limitation of movement left arm.

Procedure: The patient could neither hold his arms above his head nor independently on his stomach. By means of "Beautiful Images Cushion", the arms could be positioned and fixed in an optimal position, straight and comfortable. The injection of the contrast medium was performed without complications.

Result: The images show a very good image quality with only minimal artifacts. The liver and spleen, as well as the entire abdominal and pelvic region, can be assessed without restrictions.

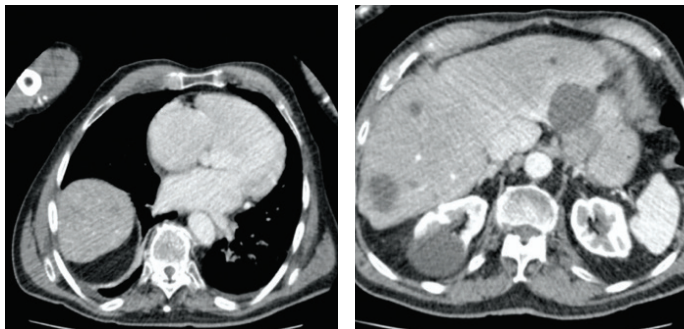


Fig. 7: Abdomen-pelvis examination with very good image quality with minimal artifacts.

Conclusion

Thorax/abdomen examinations are part of the most common CT examinations. The correct positioning of the arms is very important to avoid artifacts and unnecessary radiation exposure. In both the arms-over-head and arms-on-the-abdomen methods, patient positioning can be simplified and improved with simple measures and ap-

Case study 2: ICU Patient

Examination: CT thorax abdomen pelvis

Patient: 86-year-old ICU patient

Restrictions: Intubated and ventilated

Procedure: Since the patient's arms could not be held above the head, they were placed on the abdomen using a "beautiful image cushion". The cushion also served to hold all cables and tubes together and to guide them during the examination. The contrast medium was administered via a peripheral access on the right side and without complications thanks to the extended arm position.

Result: The images show a very good image quality, without any artifacts and can be evaluated without any restrictions.

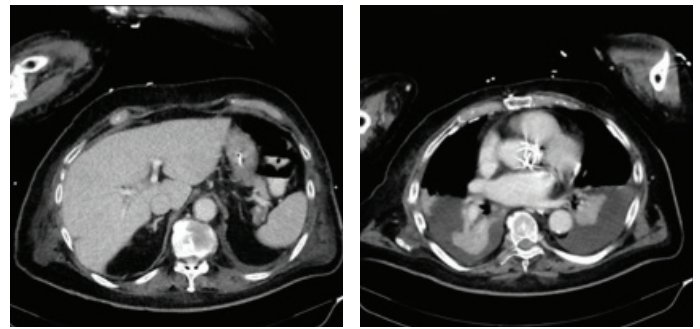


Fig. 8: Abdominal-pelvic examination without artifacts and unrestricted evaluation.

propriate positioning tools. Especially in the case of ICU or polytrauma patients, the right tools can also be a great help in securing cables and tubes.

About Alex Riemer

Alex Riemer is an independent CT application specialist, trainer and lecturer for computer tomography and medical image processing. With his mobile seminar center, he is your partner for professional training and continuous education in the field of radiology. Furthermore, Alex Riemer is the author of the book "Computertomographie für MTRA/RT" which was published by Thieme Verlag.

About Pearl Technology

Pearl Technology AG is the leading manufacturer of innovative solutions for patient positioning and fixation in radiology and beyond. The products are produced in Switzerland in accordance with ISO standard 13485 and are characterized by easy handling, high patient comfort and excellent hygiene, ensuring smooth and safe imaging workflows.