



Next step in gastroenterology

Philips MultiDiagnost Eleva with 3D-RX

Who/where

Prof. Dr. Josef Menzel,
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Challenge

Detect very small stones and other irregularities in the liver and pancreas and perform accurate minimal invasive treatment without being hindered by overlaying anatomical structures.

Solution

With the MultiDiagnost it is possible to perform a rotation with a complete series of projections. The 3D reconstructions provide detailed information on the anatomy without interference from overlaying structures.

Klinikum Ingolstadt in Germany is a community hospital with more than 1100 beds. The Department of Internal Medicine has 130 beds, and treats patients with a wide range of gastroenterological disease, including carcinoma. Radiography and fluoroscopy play a vital role in both diagnosis and treatment. Many of the procedures carried out in the department are image-guided interventions, particularly endoscopic retrograde cholangiopancreatography (ERCP), requiring advanced imaging facilities.

Prof. Dr. Menzel, Head of the Department, describes the workload of the department and the rationale behind the choice of imaging system: “We have a rather busy department, carrying out between three and five interventions per day, resulting in 15 to 25 examinations and interventions a week, or more than 700 examinations a year. This demands a reliable, high quality imaging system. I have been here in Ingolstadt for just over five years. About more than two years ago we had the chance to purchase a new imaging system. I was familiar with the MultiDiagnost Eleva from my former work in Muenster University, and for me it was the obvious choice”.

Rotational scanning with 3D reconstruction

An important feature of the MultiDiagnost Eleva is the possibility of rotational scanning with three-dimensional reconstruction. The C-arm rotates for a full 180° around the patient, acquiring a complete 3D data set.



Prof. Dr. Josef Menzel, Head of Medical Clinic II

Prof. Dr. Menzel explains: “In conventional ERCP the images are two-dimensional. The patient lies in the prone position, i.e. on the abdomen. After contrast injection into the bile duct and pancreatic duct system, the images are acquired in a single PA projection.

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Consequently, they suffer from overlying structures such as the caudal spine or the endoscope. With the MultiDiagnost Eleva we can perform a rotation with a complete series of projections. Initially, we simply recorded the scan as a movie sequence. The surgeons were very impressed by the 3D reconstruction of the anatomy. It was just what they needed to plan the surgery. So we decided to take the technique a step further, with full 3D reconstruction”.

Rotation cholangiography with 3D reconstruction provides detailed information on the anatomy without interference from overlaying structures. Prof. Dr. Menzel describes the benefits of 3D reconstruction: “The conventional examination is very straightforward. You inject contrast medium and, if you see a large stone, the diagnosis is clear. There is no need for 3D reconstruction. But if you are looking for a stone and you cannot see it, you might need to rotate the projection plan to cover more anatomical areas, or you might miss a small stone. Thus the decision to use 3D reconstruction comes immediately

after the first fluoroscopic images. The 3D reconstruction gives us far more information, allowing us to help detect small stones and other pathological processes in the bile duct or pancreatic pseudo cyst, thus offering the possibility of endoscopic interventions through the stomach wall”.

“We decided to take the technique a step further, with full 3D reconstruction”

“In the beginning, we used 3D rotation in about 15-20% of the examinations, and then increased this to 70-80% because we are interested in exploring the possibilities of the system. Now, I think we use it in about 50-60% of cases”. Prof. Dr. Menzel adds: “Of course, the major benefit for the patient is how it facilitates diagnosis and treatment. But it is interesting to see the enthusiastic reaction of the surgeons. For the first time they see the structures in three dimensions, and can rotate them for the best view, unlike the static images they are used to. They very much appreciate the extra information, and

its benefits for planning surgery, especially surgery of the bile duct system, for example for carcinoma”.

3D acquisition

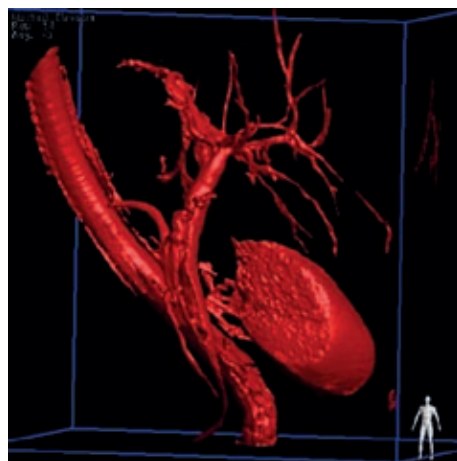
In conventional 2D ERCP the patient usually lies in the prone position, with the hands beside the body. The head is turned to the right, with the mouth wide open so that the endoscope can be inserted right down to the duodenum. The contrast agent is then injected directly into the bile duct system under fluoroscopy.

“The full 180° rotation provides a complete digital data set for the 3D reconstruction”

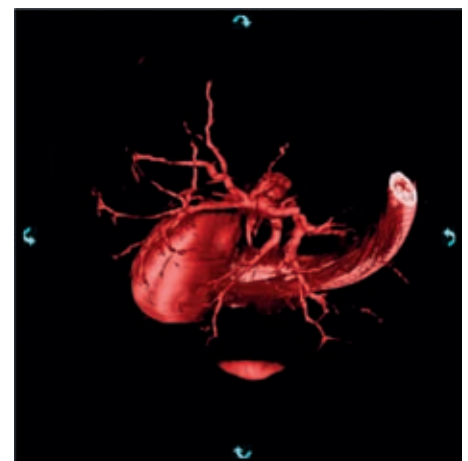
In 3D acquisition, the position of the patient is somewhat different. The patient still lies in the prone position, i.e. on the abdomen, but the arms have to be raised beside the head. The endoscope is in the same position as for the 2D acquisition. The beginning and



ERCP in plain X-ray



3D reconstruction surface rendered



3D reconstruction clear view of liquid mirror

end of the scan are defined, and the C-arm performs the rotation. The BodyGuard sensing system built into the MultiDiagnost Eleva senses the size and location of the patient, so that there is no risk of collision. The image quality is influenced by the anatomy. A thin patient, e.g. 60 kg, poses fewer problems than a large patient, e.g. 120 kg patient. However, the MultiDiagnost Eleva has enough power to examine even large patients, and automatically adjusts the exposure parameters to create the superb images. The full 180° rotation provides a complete digital data set for the 3D reconstruction.

3D reconstruction

The MultiDiagnost Eleva provides fast, high-quality 3D reconstruction in the examination room. According to Prof. Dr. Menzel: “The MultiDiagnost Eleva is unique. It gives us the possibility to have a high-end image quality with the most recent technologies and exposure control. It allows us to create movies of the regions of interest, with more information on the anatomy, and virtual online reconstruction of the three-

dimensional relationships. There are no significant time delays that could affect the workflow”.

Financial aspects

In addition to the clinical benefits, the MultiDiagnost Eleva also offers financial advantages. Prof. Dr. Menzel explains: “The financial aspects are really important for us because we are a referral center. Many patients are referred to us from second level hospitals, on an outpatient basis. Because we are able to make a diagnosis and treat the patient immediately, the time spent in hospital and, consequently, the costs are significantly reduced”.

Clinical applications

The MultiDiagnost Eleva is used for both diagnosis and treatment, often in one procedure. If a stone is detected, it can be extracted immediately. Rotational scanning takes a little longer than the conventional 2D procedure. According to Prof. Dr. Menzel: “The way of working is different, because we have to make the injection of contrast agent, make the rotation run, and

then leave the operating room to observe the images. Then we return to the patient and do the treatment. The patient is still in the same position, so the treatment can begin immediately. The examination time is about three to five minutes longer than the conventional 2D examination, but that is really a short time in view of the extra information. Conventional systems that do not have a C-arc do not have the possibility to provide the 3D impression movie sequences”.

“3D reconstruction provides more information on the anatomy”

Case study and application

A 45 year old female patient presented with pain in the right abdomen. Numerous examinations with ultrasound, CT and MRCP in different institutions failed to help detect a bile duct stone or other pathology. In the absence of pathological laboratory findings, conventional ERCP was performed in the Klinikum Ingolstadt, but also failed to show any stone.

Klinikum Ingolstadt in Germany is a community hospital with more than 1100 beds



“The patient benefits from the enhanced diagnostic possibilities and more effective treatment”

Rotational scanning was performed in several regions, with 3D reconstruction. The 3D reconstructions showed small stones in the common bile duct and the gallbladder. In all there were three small stones with a diameter of about 5 mm. The stones were extracted and the pain was immediately relieved. Another useful application of 3D reconstruction is in chronic pancreatitis. It is often difficult to locate a pseudo cyst, because it may only be half-filled by contrast injection via the pancreatic duct. 3D reconstruction and rotation of the resulting 3D cube makes it possible to see the surface of the cyst as well as the contrast agent in the cyst, to help confirm the diagnosis of a pancreatic pseudo cyst and indicating the appropriate treatment: to puncture, to drain, or to refer for surgery. This will depend on a nonmalignant diagnosis.

Radiation safety

An important consideration with rotational scanning is the radiation exposure. In conventional ERCP, the radiation exposure rate is relatively low. With rotation, it is increased by a factor of 5x to 10x. However, because rotation avoids the need for multiple exposures, the total exposure time will be



Prof. Dr. Menzel at work

shorter. According to Prof. Dr. Menzel: “We have performed about 800 examinations to date, and we have found that the overall total radiation exposure does not increase”.

Benefit for the patient

The patient benefits from the enhanced diagnostic possibilities and effective treatment. The level of comfort for the patient is not significantly less than with the conventional examination because, although the length of the examination is extended by three to five minutes, the patient is sedated and generally sleeps through the whole procedure.

Conclusion

Prof. Dr. Menzel expects the MultiDiagnost Eleva to change the working procedure in both evolutionary and revolutionary ways. The development of new endoscopic techniques offers many new possibilities for both diagnosis and treatment. According to Prof. Dr. Menzel: “We are going beyond the conventional limits. The MultiDiagnost Eleva with 3D-RX allows us to see far more than we could in the past. The revolution in imaging will open the door to new techniques, facilitating the treatment and wellbeing of our patients”.



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