



## Pediatric Hospitals Bring Low-dose CT to the Middle East

For years, radiologists have been cognizant of the importance of limiting pediatric patients' exposure to radiation dose. Building on the ALARA principle, the Image Gently Campaign specifically targets awareness of radiation dose levels to children and young adults.

However, reducing radiation dose based on a reduction in kV sometimes results in noisy images that can negatively impact the radiologist's diagnostic capabilities. For acutely sick children, such as those afflicted with heart ailments (anomalies) or pediatric cancers, treatment planning often requires high-quality CT images. Yet, radiologists may, in some instances, be hesitant to order additional CT exams out of concern that the pediatric patient is being repeatedly exposed to medical imaging radiation.

This is the case in the Kingdom of Saudi Arabia. There, two leading hospitals are using ASiR to enable a reduction in the radiation dose delivered to pediatric patients while maintaining image clarity to provide effective patient treatment.\*\*

### The beat goes on

At King Abdulaziz Cardiac Centre, Dr. Fahad Al-Habshan, a consultant in pediatric cardiology and cardiac imaging, uses CT to image children prior to open heart surgery.

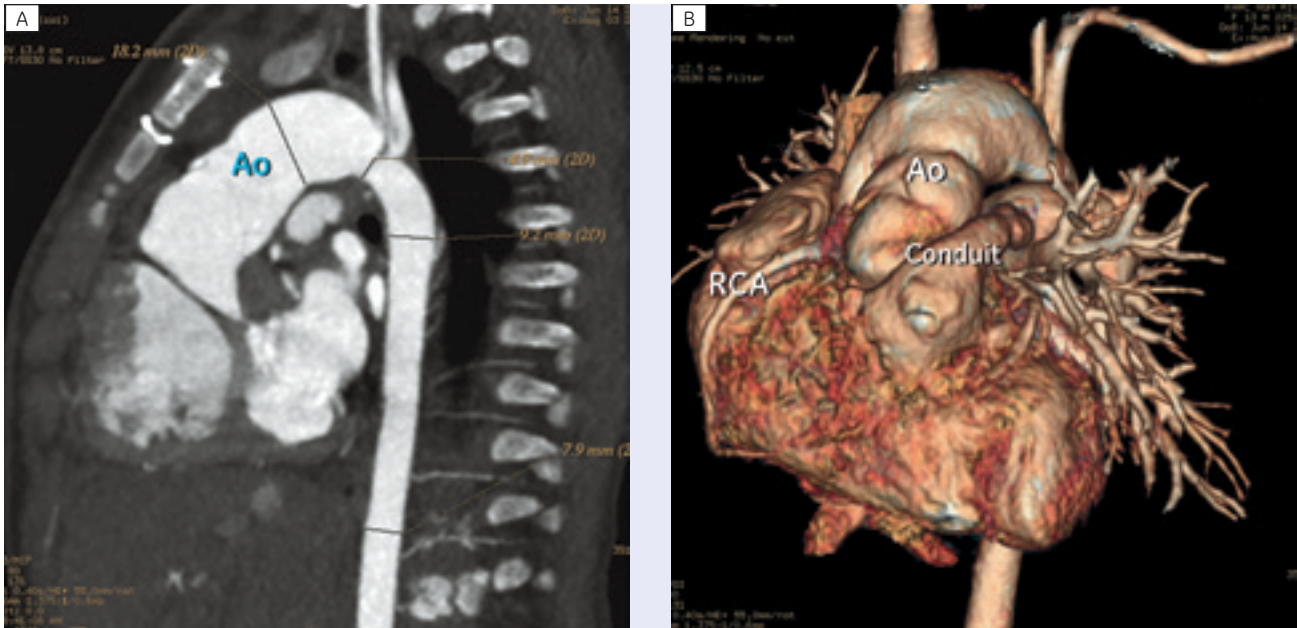
"We tried to use a lower radiation dose in our CT imaging, but the images were noisy and hazy," Dr. Al-Habshan says. "It is always a balance between the radiation dose and the clarity of the image, particularly when it comes to small children where we are



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\*\*In clinical practice, the use of ASiR may reduce CT patient dose depending on the clinical task, patient size, anatomical location, and clinical practice. A consultation with a radiologist and a physicist should be made to determine the appropriate dose to obtain diagnostic image quality for the particular clinical task.



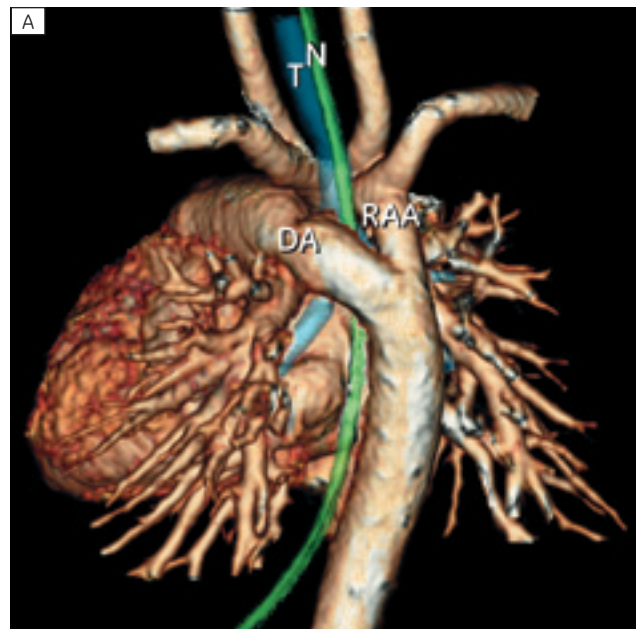
**Figure 1.** Detecting aortic arch obstruction and coronary compression in a 13-month-old girl using gated CT angiography with ASiR (0.8mSv). **(A)** Sagittal view reveals the aortic arch and an area of coarctation. **(B)** 3D reconstructions of the heart demonstrating the aortic anastomosis and the Right Ventricle—Pulmonary Artery conduit. Calculated radiation dose:  $20.57 \times 2.16 \times 0.018 = 0.8$  mSv (obtained by 2007 ICRP recommendations using chest factor of 0.018 \*DLP for children one to five years).

looking at small vessels and structures. We need to be very accurate and precise in our diagnosis of pediatric cardiac patients, and that has complicated our efforts to reduce dose.”

Specifically, the pediatric cardiology surgeons require high quality images for surgical planning. “Everything in the operating room is carefully planned; surprises add precious time that can increase the complications for very young patients,” he adds. Good images help the surgeon conduct the procedure in the shortest time possible to minimize risk to the patient’s safety. “Children are more sensitive to radiation,” says Dr. Al-Habshan.

However, when the hospital’s LightSpeed\* VCT received an ASiR upgrade in September 2009, low-dose CT imaging became a reality. “With ASiR, we obtain the same quality images at a much lower dose—it reduces the noise and produces crisp images,” explains Dr. Al-Habshan. The difference is significant. “Today with ASiR, almost all our children are imaged with less than 1 mSv radiation dose,” he adds.

“GE is focused on developing hardware and software that enhance image quality and lower radiation dose,” says Dr. Al-Habshan, “and I think that offers more benefit to the patient than the number of detectors.”



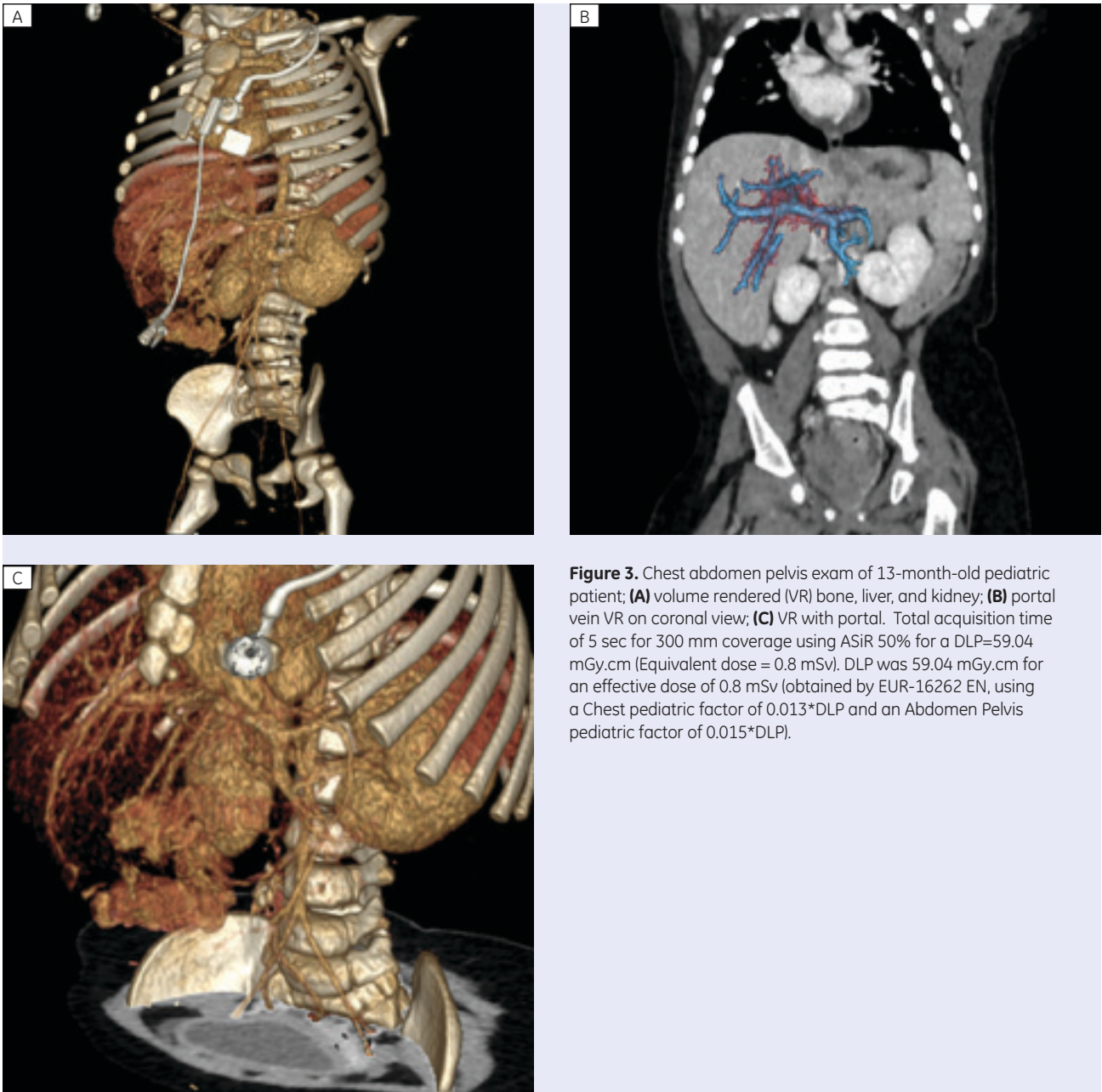
**Figure 2.** Confirming a vascular ring with mirror-image branching using CT Angiography with ASiR (0.66 mSv). 3D reconstruction of the heart shows the complete vascular ring, formed by the right aortic arch and the left-sided ductus arteriosus, around the trachea and esophagus. Also seen are the airway and the nasogastric tube in the esophagus. Notice the mirror image branching of the aortic arch, which is very unusual with this type of vascular ring. Calculated radiation dose:  $11.77 \times 2.16 \times 0.026 = 0.66$  mSv (obtained by 2007 ICRP recommendations using chest factor of 0.026 \* DLP for children under one year).

## A ray of hope

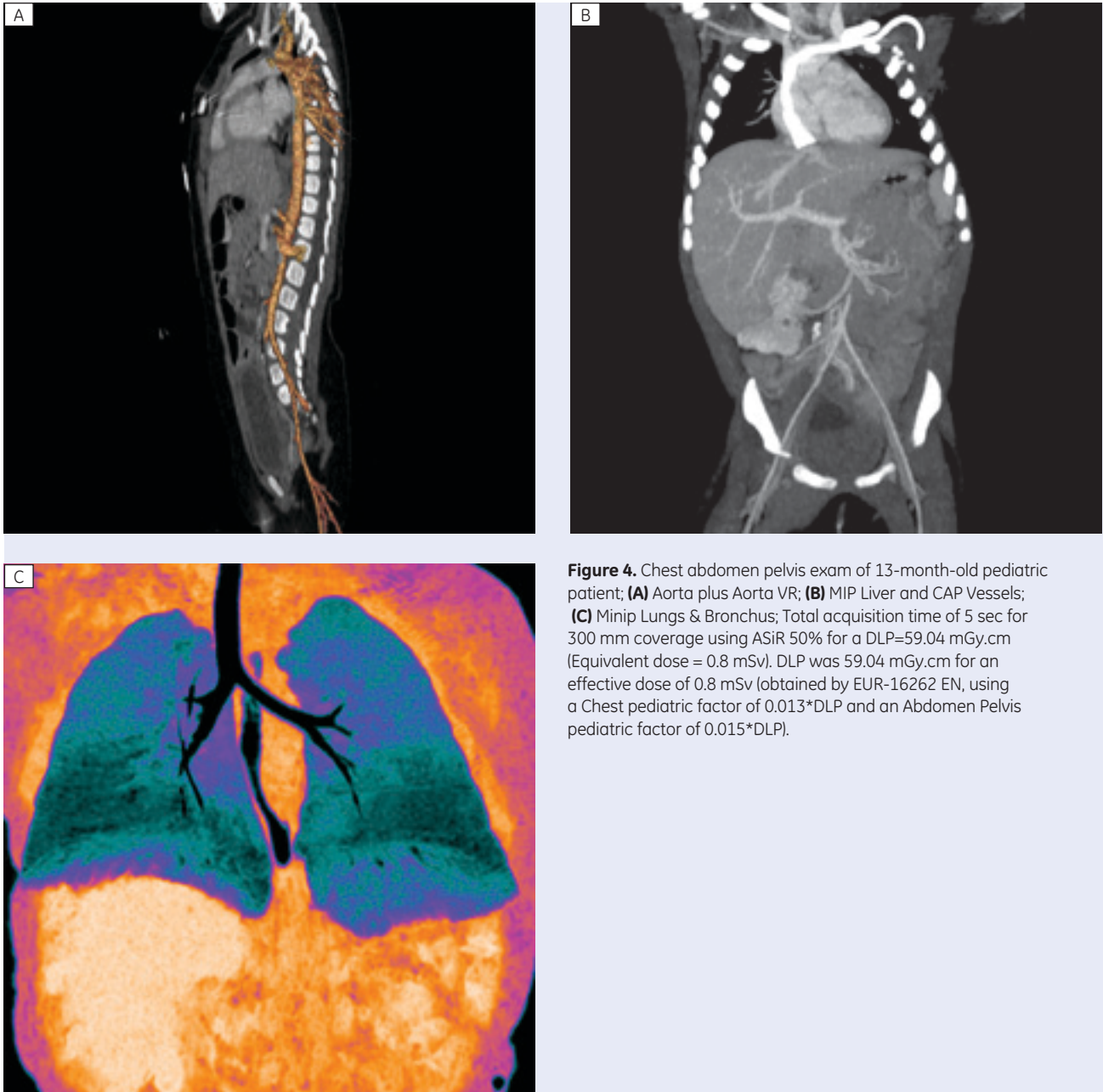
As the first children's cancer center in the Middle East, King Fahad National Centre for Children's Cancer and Research is widely recognized as a leading institution that provides comprehensive oncology care for pediatric cancer patients throughout the region. The hospital aims to provide the best level of care in medical imaging through the acquisition of state-of-the-art equipment and techniques.

"We are very concerned about the possibility of our patients' being over-exposed to radiation dose in CT scanning," says Lefian Al Otaibi, MD, Acting Chairman of Radiology and Head Section, Pediatric Radiology. The center treats patients ranging in age from three months to 14 years.

Dr. Otaibi's concern regarding dose began to diminish when he learned more about ASiR during the installation of the BrightSpeed Elite CT scanner. "We implemented it immediately to see the difference in image quality and dose using ASiR, and it was clearly noticed."



**Figure 3.** Chest abdomen pelvis exam of 13-month-old pediatric patient; **(A)** volume rendered (VR) bone, liver, and kidney; **(B)** portal vein VR on coronal view; **(C)** VR with portal. Total acquisition time of 5 sec for 300 mm coverage using ASiR 50% for a DLP=59.04 mGy.cm (Equivalent dose = 0.8 mSv). DLP was 59.04 mGy.cm for an effective dose of 0.8 mSv (obtained by EUR-16262 EN, using a Chest pediatric factor of 0.013\*DLP and an Abdomen Pelvis pediatric factor of 0.015\*DLP).



**Figure 4.** Chest abdomen pelvis exam of 13-month-old pediatric patient; **(A)** Aorta plus Aorta VR; **(B)** MIP Liver and CAP Vessels; **(C)** Minip Lungs & Bronchus; Total acquisition time of 5 sec for 300 mm coverage using ASiR 50% for a DLP=59.04 mGy.cm (Equivalent dose = 0.8 mSv). DLP was 59.04 mGy.cm for an effective dose of 0.8 mSv (obtained by EUR-16262 EN, using a Chest pediatric factor of 0.013\*DLP and an Abdomen Pelvis pediatric factor of 0.015\*DLP).

In fact, the reaction from radiologists was so positive that the facility launched a new initiative to reduce unnecessary dose to patients. The initiative includes two principles of radiation protection: appropriate justification for ordering the procedure and careful optimization of the radiation dosage used during the procedure according to age and weight.

"ASiR has allowed us to lower the radiation dose delivered to our patients compared to our previous scanner," adds Dr. Otaibi. "This is a department goal for all routine studies and with all radiologists."

The value of ASiR is most important in follow-up, or repeat exams, particularly for oncology patients who must often receive annual or bi-annual exams to detect any relapse. According to Dr. Otaibi, ASiR offers the radiologists the ability to conduct needed follow-up exams with decreased concerns of additional radiation dose. "Without ASiR, there are some follow-up exams we probably would not do," he says.

In addition to potentially minimizing dose with ASiR, the facility also utilizes the high pitch on the BrightSpeed Elite to decrease scan time, says Abdulaziz Bawazeer, Radiology Supervisor.



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*Dr. Lefian Al Otaibi*

“When scanning children, we want them to spend less time within the gantry,” he explains. “That will further help lower radiation dose and reduce motion, which helps with image quality. We also provide artwork on the walls of the room and television screens to help keep the children more comfortable and relaxed.”

With most patient cases being CAP or HN, both Dr. Otaibi and Mr. Bawazeer believe it is imperative to reduce dose in all procedures. Their results with ASiR are impressive; the studies maintain image quality and provide good visualization of contrast enhancement at lower dose and noise levels.

“We are confident our patients are receiving optimized dose without affecting the diagnostic quality of the exam,” notes Mr. Bawazeer. “And that provides the potential for outstanding clinical outcomes.”

At King Abdulaziz Cardiac Centre and King Fahad National Centre for Children’s Cancer and Research, ASiR enables clinicians to provide the highest level of diagnostic care at the lowest possible dose. ■



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Abdulaziz Bawazeer

**Abdulaziz Bawazeer** is the Radiology Supervisor at King Fahad National Centre for Children’s Cancer and Research.

**The King Fahad National Centre for Children’s Cancer and Research** opened in 1997. Located north of Riyadh on a two-acre site, it is an integral part of the King Faisal Specialist Hospital and Research Centre and provides both inpatient and outpatient services to Pediatric Hematology/Oncology patients. Seventy to 80 pediatric stem cell transplants are performed per year. The hospital is locally known as the Children’s Cancer Centre or CCC.

**The King Faisal Specialist Hospital and Research Center (KFSH&RC)** is a modern state-of-the-art hospital with 894 beds. Located in Riyadh, KFSH&RC is the national referral center for oncology, organ transplantation, cardiovascular diseases, neurosciences and genetic diseases. A full range of primary, secondary, and tertiary health care services is provided.



**Fahad Al-Habshan, MD**, is a consultant in pediatric cardiology and cardiac imaging at King Abdulaziz Cardiac Centre, National Guards Health Affairs.

**King Abdulaziz Cardiac Centre** is a tertiary care cardiac center in Riyadh, Saudi Arabia, that conducts approximately 400 open heart procedures on children every year. It is affiliated with one of the largest medical institutions in Riyadh, and provides both adult and pediatric care. The center receives pediatric referrals from all over the country.

