

**PRESENT DAY CONCEPT OF
NON-INVASIVE IMAGING**

A succession of events in the early seventies following the discovery of computerized tomography by Hounsfield led an explosion of newer techniques and their resulting sophistication, which have seen incredible changes in the field of diagnostic radiology. Radio-diagnosis became a direct imaging science instead of a subjective interpretation of indirect signs on radiographs, changing our entire concept and orientation of disease process evaluation. The emphasis in the last decade has been on not only visualizing the lesion, defining the effect it has on surrounding and distant viscera but also in delineating the intrastructural details with minimum of intervention and discomfort to the patient.

Pediatric radiology has changed dramatically since 1980. A large part of the change is due to the impact of the various new modalities, particularly ultrasound, which has become a major part of pediatric radiology.

Ultrasound (US) has the main benefit of no radiation hazard in addition to being non-invasive, very sensitive and a rapid technique. It leads the imaging procedures for antenatal fetal health. Early diagnosis of major congenital cardiac, neural tube and visceral anomalies help in decision making of either termination or intra-

uterine therapeutic intervention. Major areas in these are intrauterine shunt surgery and exchange transfusion.

The contribution of sonography in evaluation of the neonatal brain, viz., the natural acoustic window of patent fontanelle is commendable. Premature infants are examined by portable scanners in the controlled environment of the nursery itself as sonography is extremely sensitive and specific in the detection and follow up of intracranial hemorrhage. Subependymal and intraventricular hemorrhage does not cause neonatal death but does often lead to neonatal and even lifetime brain damage. Periventricular leukomalacia and disorders of organogenesis such as Dandy Walker Complex, macrocephaly and holoprosencephaly are easily diagnosed. Infective pathologies involving the brain parenchyma and ventricular system can be easily evaluated. It scores over all the modalities in demonstrating ependymitis and intraventricular pathologies especially intraventricular septae. US is increasingly being used to evaluate the spinal cord, canal and thecal sac in newborns and infants for spinal dysraphic states with intraspinal abnormality such as a dermal sinus, dermoid tumor, lipoma, tethered cord or diastomatomyelia. Excellent images of the spinal cord, canal, and thecal sac can be seen in children upto the age of 6 months.

At one time the clinical finding of an abdominal mass in a child resulted in a laparotomy or more traditional imaging modalities such as plain radiography, barium studies or intravenous urography. Now-a-days, sonography is the primary imaging modality for a vast majority of

abdominal lesions. Its role in identification of hepatobiliary system, renal and supra-renal pathology, retroperitoneum and pelvis is paramount. It depicts the nature of a lesion whether solid or cystic and the organ of origin whenever possible. The local and distant abnormalities often decide the most appropriate medical or surgical therapies. Gas and bone are a limitation and a complete view of the entire abdomen in these cases can be obtained only by a CT. In some processes in the musculoskeletal system, US has become the primary imaging study performed. The area of most common use is around the hip joint. Two primary uses are in the detection of hip joint effusions and congenital dysplasias. Periarthritic inflammatory processes such as myositis, soft tissue abscesses and hematomas can be evaluated and guided therapeutic procedures undertaken.

Echocardiography is the single most effective non-invasive modality in the rapid diagnosis of congenital cardiac and vascular malformations. Doppler with colored flow mapping has altered the approach to soft tissue vascular malformations. In the abdomen, portal hypertension with a patency of shunts, renal circulation in diseases affecting the renal vessels, trauma and renal allografts can be evaluated. Patency of the aorta and IVC can be easily established. Future investigative possibilities are in defining the malignant nature of a mass by its abnormal vascularization, evaluating acute scrotal symptoms, identifying the refluxing or obstructed ureter by the abnormal urine jet it emits into the bladder.

Computed tomography (CT) with the now available fast scanners provides excellent cross-sectional anatomical details. This modality although significantly superior to sonography in terms of resolution

and range of organ imaging has some limitations in pediatric imaging: (i) Its role in the prenatal diagnosis is non-existent due to radiation hazards; (ii) It is technically difficult and hazardous in neonates, premature and sick infants; and (iii) Anesthetic and contrast hazards need to be considered when more than one examination is required.

CT has, however, completely changed the work up of a child with suspicion of intracranial disease. It is the quickest and most easily performed examination in the acute management of head trauma and is the single best modality for abdominal trauma which permits detection of multifocal injury in the abdomen. Mediastinal masses, airway obstruction, abdominal and pelvic pathologies and musculoskeletal lesions like tumors are completely evaluated.

Magnetic Resonance Imaging (MRI) is the latest imaging modality which provides access to the cellular structure with no intervention. It scores over CT as it involves no ionizing radiation; no bony artifacts; has superior soft tissue contrast resolution; multiplanar imaging capabilities and no contrast is required even for vascular studies. The main limitation of this excellent modality is its cost and its inability to evaluate calcified/bony lesions adequately. MRI due to its multiplanar imaging capability along with superior soft tissue contrast has largely replaced CT in evaluation of spine and brain. Its ability to differentiate between grey and white matter helps in studying the process of myelination and various demyelinating diseases, not possible on CT. MR is the method of choice for evaluation of posterior mediastinal masses due to their propensity for extradural tumor extension. Intrathoracic vascular anomalies and masses can be depicted anatomically, delineating the

vascular relationships and permitting tissue characterization. Musculoskeletal system is imaged in great detail with MRI. With the rapid improvement in technology and development of faster techniques it is possible that MR angiography may replace conventional angiography for suspected vascular lesions in the near future. However, the earlier expectations that MR would be able to provide the histopathology of a lesion has not come true. MRI may, in the near future give us not only the anatomical and structural details but also provide the cytopathology without any intervention.

Most of these non-invasive modalities, which have altered the modern day diagnostic approach in pediatrics, require a high degree of operator skill in image

acquisition and interpretation and, we have yet to reach a stage of expertise. Moreover, a major bulk of problems in the pediatric age group are due to infective lung lesions and skeletal disorders which are still diagnosed on conventional radiographs.

The systematic diagnostic approach to many pathological possibilities is both complex and intellectually challenging. An integrated imaging approach to pediatric problems emphasizes the critical role of conventional radiography, ultrasound, computed tomography and magnetic resonance.

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NOTES AND NEWS

INTERNATIONAL CONFERENCE ON SLEEP-WAKEFULNESS

An International Conference on Sleep-Wakefulness is to be held from *September 9-11, 1992* at New Delhi.

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