A Simple Device to Couple Linear Array Transducers to Neonate Heads for Ultrasonic Scanning of the Brain[1]

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A plastisol coupler has been designed that improves acoustical coupling for linear array ultrasound transducers. This device improves both ease in scanning and image quality in real-time scanning of the infant brain.

INDEX TERMS: Brain, ultrasound studies, 1[0].1298 • Infants, newborn, central nervous system • Infants, newborn, ultrasound studies • Ultrasound, instrumentation

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Ultrasound is an excellent means for screening neonates for brain abnormalities (1–3). The widespread availability of portable real-time devices has made it possible to examine critically ill infants in their Isolettes, thereby eliminating the hazards associated with transporting and handling these babies. The large size of linear array transducers, compared with the baby's skull, has caused mechanical coupling problems during the procedure. This report describes a coupling device we have designed, which fits over the face of a transducer and affords good contact with the infant's head during scanning in coronal, horizontal, and sagittal planes.

METHOD

Several sizes of couplers have been fabricated to cover the range of curvatures encountered in scanning neonate heads. Aluminum molds were machined to dimensions appropriate for a specific transducer and radius of curvature desired. Plastisol casts were made after thorough mixing for four hours, degassing for one hour, and curing at 150°C for approximately one hour. In order to prevent multiple reverberations, which appear as artifacts in the image, attenuating wedges are cast into the body of the coupler (Fig. 1). These wedges are configured in a manner to accept ultrasound reflected primarily in a direction perpendicular to the sound-propagating pathway from the array. These reflections, if unattenuated, can find their way back into the array and appear as artifacts in the displayed image. The wedges are built with an angular configuration for acceptance of these unwanted reflections which, when trapped in the wedge, are highly attenuated. This attenuation is the result of the aluminum powder cast within the plastic, which provides a highly attenuating scattering loss characteristic. The coupler was then attached to the transducer face with a metal clamp tightened around both transducer and coupler, as illustrated in Figure 2. The couplers are soft and pliable, and one curvature can be used to fit a range of head sizes when gently pressed against the head.

DISCUSSION

The use of these couplers makes it feasible to take advantage of the broad field of view afforded by the linear array transducer (Fig. 3). One advantage of this is that the anatomical comparisons to known formats, such as computed tomographic sections, easily can be made. There is also a report suggesting that there is less distortion of the anatomy when the larger field linear array systems are used (4).

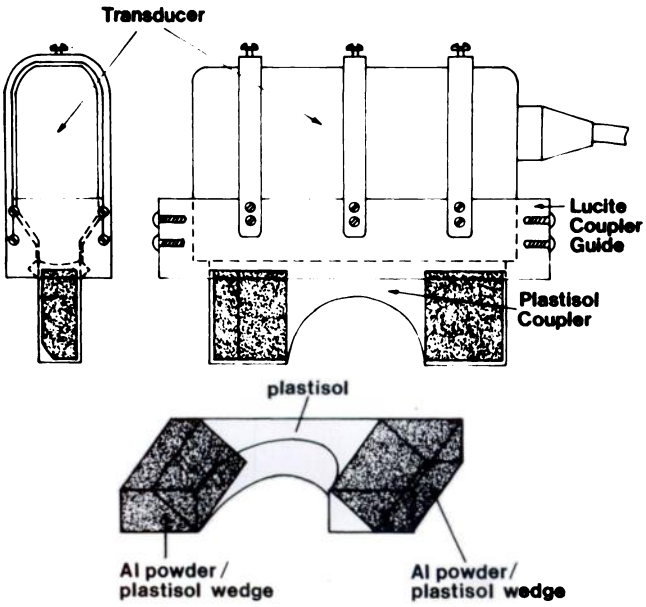

Fig. 1. End view and side view of the coupler, with the shaded area representing the aluminum powder absorber embedded in the plastisol coupler.

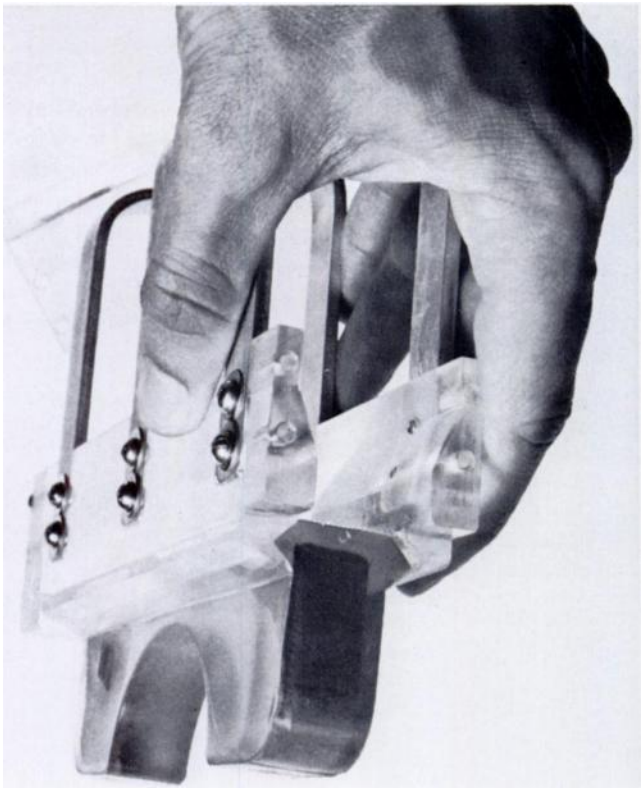

Fig. 2. View of the coupler and clamp ready for attachment to the linear array transducer. The transducer slides into the brackets.

3a,b

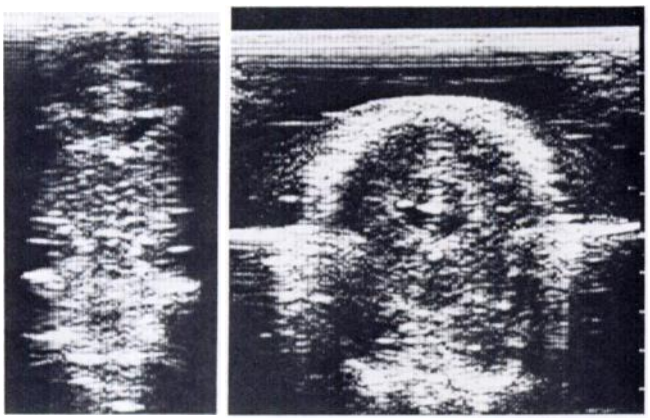

Fig. 3a. Without the coupler, there is a limited field of view of a coronal section at the level of the anterior horns of the lateral ventricles. The small field of view is caused by the size discrepancy between the transducer face and the rounded infant skull.

b. With the coupler, the entire convexity is seen, as well as the temporal lobes and vascular structures at the base of the brain.

In general, linear array real-time units are less expensive than mechanical or phased array sector scanners. This factor has in part been responsible for the widespread use and availability of these scanners. If ultrasound is to fulfill its potential for use as a screening device for intracranial abnormalities, an inexpensive adapter that will allow any linear array device to become a head scanner has obvious advantages. The coupler we describe is a prototype that can be fabricated in any appropriate engineering shop. It is our hope that commercial couplers of this type will be available in the near future.

REFERENCES

1. Skolnick ML, Rosenbaum AE, Matzuk T, et al: Detection of dilated cerebral ventricles in infants: a correlative study between ultrasound and computed tomography. Radiology **131**:447–451, May 1979
2. Kossoff G, Garrett WJ, Radovanovich G: Ultrasonic atlas of normal brain of infants. Ultrasound Med Biol **1**:259–266, Aug 1974
3. Pope KE, Cusick G, Houang MTW, et al: Ultrasound detection of brain damage in preterm infants. Lancet **1**:1261–1264, 16 Jun 1979
4. Davies P, Stockdale H: Ultrasound examination of neonatal heads. Lancet **2**:38, 7 Jul 1979

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A Comparison of Methods for Assessing Patient Body Burden Following ^{131}I Therapy for Thyroid Cancer[1]

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The effectiveness of three methods of assessing the patient body burden following ^{131}I therapy was compared: (*a*) urine assay, (*b*) external exposure rate measurements, and (*c*) predictions based on a pretherapy diagnostic work-up. The urine assay method exhibited the greatest potential for error and personnel risk. The diagnostic work-up provided predictions of the body burden as a function of time, which may be applied to estimate the expected hospital stay. The direct external exposure rate survey showed the potential for being an accurate, reliable, and relatively safe method of monitoring the patient body burden.

INDEX TERMS: Iodine and iodine compounds, radioactive • Radiations, measurement • Therapeutic radiology, dosimetry • (Thyroid, effect of radiation, 2[73].470) • Thyroid, neoplasms • (Thyroid, nuclear medicine, 2[73].1299)

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In the treatment of thyroid cancer, patients may receive single therapeutic doses of approximately 200 mCi (7.4 GBq) of ^{131}I. It is necessary to monitor the patient's radioiodine body burden in order to determine a hospital release date and, in some situations, for dosimetry considerations (1). Current Nuclear Regulatory Commission (NRC) requirements specify that the ^{131}I body burden be below 30 mCi (1.1 GBq) before the patient can be discharged. The National Council on Radiation Protection and Measurements (NCRP) recommends that the patient be released when the exposure rate to other individuals would be less than 0.5 rem (0.005 J/kg) per year (under nonrestrictive conditions), corresponding to a whole-body burden of about 8 mCi (0.3 GBq) in the case of ^{131}I (2). We compared three methods of evaluating the ^{131}I body burden in a practical clinical setting. These were: (*a*) urine assay, (*b*) external exposure rate measurements, and (*c*) predictions based on a pretherapy diagnostic work-up.

METHODS

Urine Assay

A traditional method for monitoring radioiodine body burden has been to assay the collected urine. Numerous steps are required in the urine assay procedure which are time consuming, prone to inaccuracies, and involve personnel risk due to the high levels of activity administered. We analyzed various aspects of the assay method in detail in order to define the significance of these problems. The urine assay method involved:

(*a*) obtaining, transporting, and storing the urine containers;

(*b*) measuring the total urine volume;