DETECTION OF NORMAL LIVER STRUCTURE BY ULTRASONIC TECHNIQUES*

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The approach taken in the present study to the problem of detecting the structure of normal human liver by ultrasonic techniques is to use the cat as an experimental subject since its liver is morphologically similar to that of the human. Consideration was also given to the study of the livers of other species with anatomic features which might form good reflecting targets for the ultrasonic energy. The liver of the adult pig makes a most interesting subject for acoustic study: its basic architecture is similar to that of other mammals (including man and cat) with the exception of the presence of connective tissue surrounding each lobule; this connective tissue structure is dense and completely distributed throughout the liver in a regular repeated pattern. A series of acoustic visualization experiments were carried out on sections of freshly excised liver of adult pigs and adult cats. The general result found was that at cathode ray intensity and amplifier gain settings at which essentially no reflections could be detected from the excised liver of the cat, dense reflections were recorded throughout the tissue of the pig. With increased instrumentation sensitivity, however, acoustic reflections could be obtained from the internal structure of the normal cat liver.

A series of in vivo ultrasonic visualization experiments were also carried out using both the adult cat and a purebred strain of young pigs (ranging in age from three to eight weeks of age). The histologic structure of the liver of the young pig is of interest when compared to that of the adult pig and the adult cat, insofar as acoustic reflections are concerned. These ultrasonic visualization experiments were carried out using a unique biological preparation in which part of a liver lobe of the live cat and the young pig was extruded outside the abdominal wall with circulation completely intact. This preparation had all the advantages of an in vivo sample with intact circulation with the added advantage that the liver tissue was directly exposed to the sound energy without any interference of overlying tissue. (See Figure 1). Using this preparation success was obtained in detecting the internal liver structure of both the young pig and the adult cat.

It was also found that when the liver was not extruded but remained intact in the live subjects, the normal liver structure could be acoustically detected in both species. In order to study further the role of connective tissue, preliminary acoustic and histological studies were carried out on excised beef liver. The results obtained in this study are important in clarifying some aspects of the problem of using ultrasonic energy for the detection of the structure of normal human liver.

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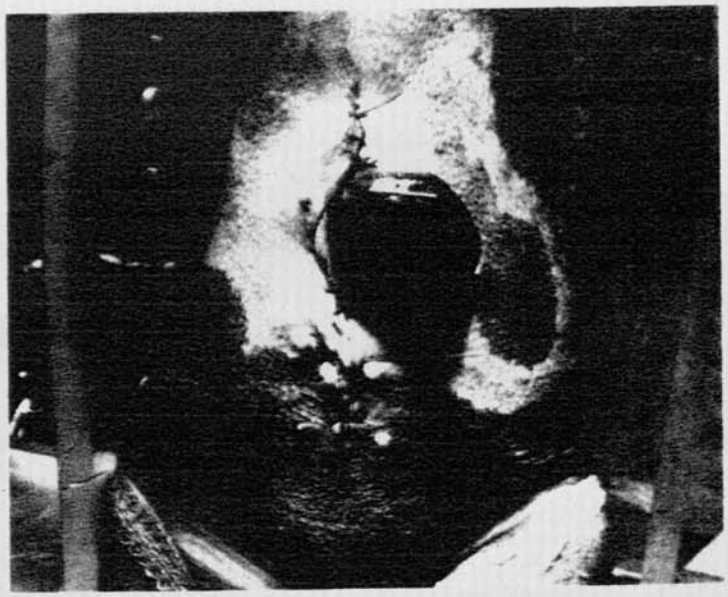

FIGURE 1. 6-week-old live pig with section of liver exteriorized for acoustic examination. Pins have been inserted in surface of liver tissue as acoustic markers.

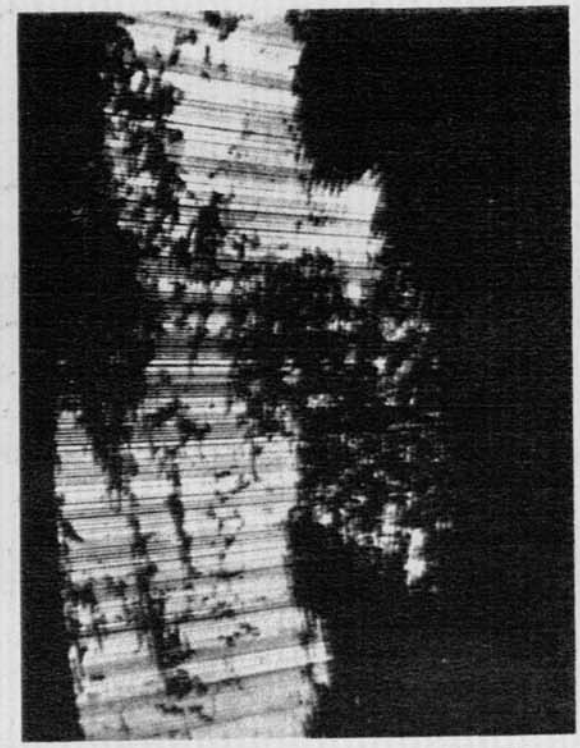

FIGURE 2. Echogram of exteriorized liver of pig shown in Figure 1. Ultrasound frequency 1.00 MHz.