CHAPTER - I
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INTRODUCTION

The term ultrasonics is used in acoustics to denote frequencies above 20 kHz and is typical in not being perceived by human ear. The 20 kHz frequency is arbitrarily-fixed lower limit and the ultrasound can go up to a very high frequency of even $5 \times 10^5$ kHz. The fundamental principles and the physical acoustics of ultrasound are the same as that of the audible sound.

The field of ultrasonic biophysics had its beginning near the end of the 1st world war when ultrasound was used to locate submarines. As early as in 1927 this form of energy was given a series of application value. A piezoelectric transducer in a circuit containing appropriate capacitors and inductors was existed by a Poulsen arc converter to vibrate at a resonance frequency for emitting ultrasound. Extensive investigations on the phenomenon were carried out and ultrasound biophysics became a separate entity in physics as well as in acoustics.
Subsequent to the development of electronics during the mid 20th Century, instruments for measurements were developed and absorption attenuation and impedance could easily be calculated. Radar techniques yielded to pulseecho ultrasound instruments. The lens focus system and field measuring schemes have made high intensity ultrasound to be employed to the biological media. Following this, two schools of thought evolved, one concentrating on biophysical techniques of application of ultrasound on to the biological materials and the second group investigating in detail the effect of ultrasound on the biological material. With further finer improvement of pulseecho techniques the medical field started employing ultrasound as a diagnostic tool. On the other hand the continuous wave of ultrasound, at low intensities was used for therapy of some diseases and ailments where in deep seated heating is required; and in tumours degrees of degenerative necrotic changes was achieved. The phenomenon is like cooking the tumour without touching the skin. Being a non-ionising radiation
energy, ultrasound is gaining more and more attention in clinical procedures. Today, the investigation of ultrasound and its effects on biological media has gone to the molecular level. A large number of apparatus with varying ranges of frequencies and intensities are available commercially. This is the result of arduous, zealous work of the group of workers involved in physical aspects of ultrasound. Variety of materials used for preparation of transducers are Quartz, Ceramic, Rochelle salt, Barium salt and Zerconite. Although a fixed frequency of 1 MHz is in extensive use, the range of application in the medical field varies from 0.5 to 10 MHz. A combination of continuous and pulsed emittance is designed with the range of 0 to 21 watts/cm². Inspite of its excellent safety record, ultrasound is bound to produce some unwanted effects, which may go unnoticed at the time of the application or immediately following the application. The threshold level must be adhered to failing which some pathogenic effects might be produced at the tissue level. The histomorphological changes thus occurred may or may not be in a position to bring about
change in the organ and organismal physiology. However, a continuous use of this diagnostic tool, which in the present days is indiscriminately and very frequently being used, can certainly damage the histology and as well as physiology of the organ. This property, though appears insignificant, is to be studied in depth to help the clinicians for proper and selective application of ultrasound on the patients. There are a large number of advantages like preferential heating depending on the nature of the tissues, the penetration capacity which is inversely related to the frequency and a perfect control with which thermal effects that can be brought about at various depths. Whenever ultrasound is used as means of heating, non-thermal effects also occur simultaneously with the increase in the temperature and these effects can interact constructively or destructively.

The use of ultrasound to treat malignances started about 50 years back. However there was a period of pessimism and dormancy of about 30 years. But the revival took place and low intensity long time exposures, high intensity short time exposures started becoming more and more
popular. Besides its sole application, ultrasound was used in combinations with chemotherapy and radiotherapy. Ultrasound in combination therapy has been found very useful since it enhances the chemotherapy in human neoplasms and accelerates the radiotherapeutic procedures. Its usefulness in treating in solid tumors is promising because of the ability to localize in the desired areas.

After extensive search in the literature it is felt that less information is available on the effect of ultrasound on an important organ like liver. Moreover the frequent exposure of liver to ultrasound in the present day medical practice leads to a point wherein any addition, to the existing knowledge would be welcome. Hence the present investigation is undertaken. Hitherto the exposures were made in aqueous coupling medium as far as the animal model is concerned, whereas the direct coupling method is being used for human beings in clinical studies. Hence I deem it worthwhile to follow the same technique of direct coupling and to study effect. Earlier workers preferred high intensity short time exposure or low intensity long time exposure or high intensity and long time
exposure. I have selected 10 Watts and 15 Watts as intensities, spread the total time of exposure of 5 minutes in a 5 day regime. Histopathological parameters are taken up to study along with aminotransferase analysis since the transferase activity is associated with the rate of metabolism in the given organ. Hence the present investigation is justified in undertaking and the results would help a clinical diagnostian to select correct bioacoustical parameters.