

COMMENTED SUMMARIES FROM CURRENT MEDICAL LITERATURE

ADVANCES IN ULTRASOUND: FROM MICROSCANNING TO TELEROBOTICS

Summary: This paper is in memory of W. V. Mayneord (1902-1988). Experiments conducted in Mayneord's Laboratory were amongst the first to show that ultrasound had diagnostic potential. Now, one in every four imaging studies uses ultrasound. Amongst numerous contemporary advances, microscanning is concerned with imaging subcentimeter size volumes of tissue in three dimensions with 10-100 microns resolution. The traditional approach is by pulse echo imaging, with a focused ultrasonic beam in the frequency range 20-100 MHz. This approach may be complemented by ultrasonic CT (to correct for attenuation and speed variations), reflex transmission imaging (to provide attenuation data) and synthetic aperture scanning (to decrease imaging time). Harmonic microscanning may reduce artifacts, and elasticity imaging may also be possible. Microscanning is likely to have applications in pathology and in the operating room, for trackless microinterventions, in molecular biology and studies, and in experimental imaging of small mammals including, in particular, the mouse. Robotics is the engineering science concerned with devices that are able to execute tasks usually performed by humans. Two procedures, ultrasonically guided biopsy and ultrasonic laparoscopy, are being used to demonstrate the feasibility of telerobotics. The approach is that of telepresence, as distinct from supervisory control or virtual reality. Problems associated with image compression and communications latency are identified. Although incremental developments in medical ultrasound have resulted from clinical pull, major advances have, in general, been due to technical push.

Comment: Implementation of the ultrasound (US) as a diagnostic tool in our medical community is not fairly new. It has started with a few years of delay since its global propagation in 1952. Several factors played an essential role in due attraction of our physicians, not only radiologists but also other colleagues as well, to welcome this new modality. Technical facilities concerning the installation, low price of the equipment compared to radiology units and ease of practical approach with limitations in diagnostic requirements were enough to induce a provocative obligation for every radiologist to keep pace with their recently graduated colleagues in updating their own routine diagnostic work.

Unfortunately instead of extension of the technique to the scientific field and research to get advantage of its potential physical capabilities, its economical aspects arose the ambition of nearly everyone in the medical field to use it only for their own benefits. Consequently, the US didn't stay contained in imaging practicing people's hand, and other specialty physicians grasped this practically easy technique considering only the exaggerated reputation of the US for being non-invasive or with negligible harm to human organ tissues.

It was nothing to be blamed if other aspects of this surprising modality were considered as well. But despite all these attempts, in very exceptional situations, an encouraging enthusiasm could be noticed for the scientific issues of the US. The greatest energy power of the US in our area, as well as the majority of developing countries, did not surpass 7 or at the most, 10 MHz used endosonography. It is very seldom heard or read of the use of this powerful energy for academic practice such as US microscopy, US microprocessing, US histology and other aspects of this potential multifactorial capability and powerful energy of the 3000 MHz range. The latest use of the operational ultrasound, as far as I know, has not been popularized yet.

Newly discovered aspects of the US potential ability in microscanning very small tissues with subcentimetric volume and spatial resolution of 1-10 μ m, such as US microscopy or ultrasonic CT are amongst the beneficial tools for a scientific research owing to the US penetration in tissues, which is much deeper than the ordinary light and perhaps comparable to LASER in some way.

All in all, what is surprisingly odd for us relies on the use of the US robotics in the medical practice. Although it seems inevitable nowadays to suppress robots in the practical medical care, we are witnessing its progressive use in this setting and even in the cardiac surgery but the matter appears different concerning the US. Among the different characteristics of the US, we insist on a unique superiority of this kind of

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imaging; it is very operator dependent and because of this, in contrast to some developed countries, we still prefer the US to be used in the physician's hand instead of the sonographer's desire. We believe that it is the talent or the common sense of the operator that creates a reliable image not the equipment itself. We consider this to be the great preponderance of the US compared to other medical imaging modalities. None of these modalities requires this obligation, except for interventional imaging methods. Giving this valuable task to an incomprehensive equipment means to betray the main character of this precious tool (an operator dependent device).

Having someone close to listen to our complaints, to support us morally while in trouble and to advise us as a trustful physician, should not be replaced by a wild technological machinery. Considering the mental susceptibility of the patient to need this physiological support, the role of humanitarian affection still has the primary influence, even though robots can do what mankind could accomplish.

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Source: Welles PN. *Br J Radiol.* 2000; **73**: 1138-47.

COMBINATION THERAPY WITH TRANSCATHETER ARTERIAL CHEMOEMBOLIZATION AND PERCUTANEOUS MICROWAVE COAGULATION THERAPY FOR HEPATOCELLULAR CARCINOMA

Summary: A small number of microwave electrode insertions and microwave irradiations were used to obtain complete tumor necrosis in hepatocellular carcinomas (HCC) measuring > 2.0 cm but <3.0 in greatest dimension. The efficacy of combining transcatheter arterial chemoembolization (CTACE) with subsequent percutaneous microwave coagulation therapy (PMCT) was assessed in this study.

Eighteen patients with cirrhosis and HCCs measuring > 2.0 cm but <3.0 cm in greatest dimension underwent TACE followed by ultrasonographically guided PMCT within 1-2 days.

On dynamic computer tomography, 17 of the 18 patients showed complete necrosis of their tumor lesions and the treated tumor margins (>5mm). Necroses of tumors and noncancerous margins surrounding the tumors were obtained using 4 microwave irradiations (1 session) in 14 patients, 5 microwave irradiations (2 session) in 2 patients, and 6 microwave irradiations (2 sessions) in 1 patient.

The follow-up period was short (12-31 months) and there was no mortality. No local recurrences in the treated areas were detected and fatal complications were absent. Pleural effusion was observed in 1 patient only.

This combined therapy of PMCT applied within 1-2 days of TACE effectively treated HCCs measuring > 2.0 cm but < 3.0 cm in greatest dimension. A small number of microwave electrode insertions and microwave irradiations were used.

Comment: Hepatocellular carcinoma because of silent and late clinical presentation, has a high mortality. It is a chemo-radiotherapy resistant tumor with locally aggressive behavior but so early metastasis is rare. Only those with isolated single lesions can be good candidates for surgery.

All types of regional therapy certainly can save these patients, because this tumor usually extends locally. In this paper, the five-year survival is 70%. Regarding the importance of this disease, it is necessary to develop these kinds of local therapy^{1,2} in our country in order to achieve ideal survival for patients.

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2. Murakami T, Shibata T, Ishida T, et al. Percutaneous microwave hepatic tumor coagulation with segment hepatic blood flow occlusion in seven patients. *Am J Roentgenol.* 1999; **172**: 637-40.

Authors: Nourani-Khojasteh H. MD, Shiraz, Iran.

Source: Toshihito S, Toru T. *Cancer.* 2000; **89**: 124-51.