system, automatic alerts appear for new articles that have been published since the last time the subscriber logged in. This is important because research findings will be published continually, within 24 hours of acceptance. These automatic on-screen alerts will notify readers about any letters, rebuttals or reactions related to the articles selected by the reader.

AAAS has· also decided to alert subscribers with special interests (such as AIDS) by fax any time new articles are published in that subject. These fax notices will include the title, author and date of publication.

Current Clinical Trials offers the most sophisticated search and retrieval capacity of any computer data retrieval system currently available anywhere in the world. Subscribers can search the database of articles by keyword, subject, author or title. Fast and tightly focused searches for specific data, figures and table captions are also possible. Readers may also view an article's components—abstract, full text, references, graphs, etc.—in any order they wish. Each paragraph is numbered to facilitate locating specific data, and in referring to them in subsequent papers these paragraph numbers will replace the page numbers used when one refers to an article in a print journal.

One facility that will never be possible with a print journal is immediate Hypertext links to abstracts of articles cited in MEDLINE. Readers scanning any journal article's references can use the mouse to select a MEDLINE abstract for that study, and see it in a pop-up window on screen without leaving the *Current Clinical Trials* article they are reading. All articles published in the new journal will be automatically included in BIOSIS. Also being planned is online access to a methodology database that will allow readers to point the mouse at any methodological term for which they need explanation; a Hypertext link will allow the reader to see a one-page definition of the term in a pop-up window on screen.

Readers can order reprints of articles in printed form, or they can download articles if they have MS-Windows-supported printers.

Authors can submit articles electronically through networks, via modem, as hard copy, or on diskette. Articles will be sent electronically to peer reviewers and comments collected from them in the same manner. When an article has been accepted by the editors, copy-edited, coded, and indexed (all at AAAS, Washington, DC), the journal will notify OCLC via e-mail and OCLC will download the text for typesetting and tagging. Text and graphics will be developed on PCs; and the online system itself runs on an IBM 3090 mainframe at the OCLC computer facility in Dublin, Ohio.

Subbiah Arunachalam, Publications and Information Directorate, CSIR, New Delhi

Online bibliography on fullerenes

A new bibliography on fullerenes alerts fullerene researchers worldwide to the latest developments in this hot field. The bibliography, called 'The Almost (but never quite) Complete Buckminsterfullerene Bibliography', is compiled by Richard Smalley, who first synthesized the C_{60} molecule buckminsterfullerene, at Rice University in Houston, USA. It is updated twice a day, and made available worldwide via e-mail or fax, or as printout. The bibliography also lists addresses of all major groups working on fullerenes worldwide. The address for fullerene researchers to contact is Prof. Richard E. Smalley, Hackerman Professor of Chemistry, Rice University, P. O. Box 1892, Houston, TX 77251, USA.

Subbiah Arunachalam

RESEARCH NEWS

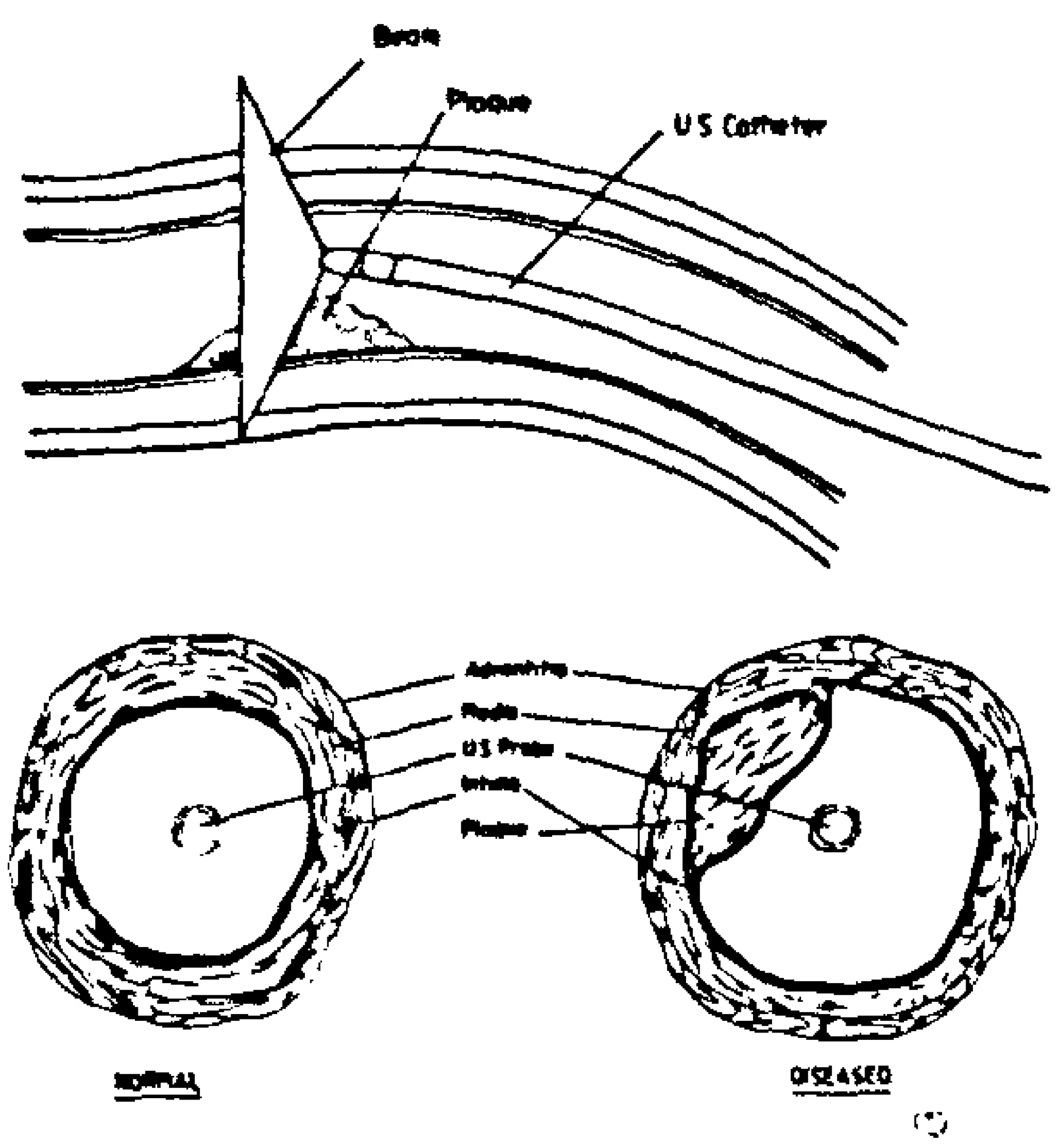
Ultrasound images vessel wall from within

K. Ravi Mandalam

Rapid advance made in the treatment of vascular diseases using interventional procedures like angioplasty has necessitated development of methods to assess and monitor their effects. Several new imaging techniques have been introduced for this purpose. Among them, intravascular ultrasound has emerged as a promising technique for high-resolution imaging of the vascular wall.

The use of sound waves as an imaging tool in medical diagnosis dates back to the early fifties when Howry and his associates pioneered the application of this method[1]. Most of the early devices used for medical ultrasonography were modified versions of SONAR (sound navigation ranging) devices, which found successful applications in the two world wars. Since then, vast improvements and rapid progress have been made in medical ultrasound technology and instrumentation, resulting in widespread use of the technique in imaging virtually every part of the human body. Thus we have dedicated systems for imaging the abdominal organs, the heart, the brain, the extremities and other parts of the body.

Conventional ultrasonic images are generated by placing transducers containing ceramic crystals susceptible to the piezoelectric effect on an appropriate part of the body surface covering the organ to be studied. While this technique has been satisfactory in imaging the heart and most of the superficially situated abdominal organs, it has been less than optimal for deeper structures, since these structures are obscured by overlying gas shadows in the intestines and intervening dense bony parts. Consequently, technical developments were made to address this problem, and in the eighties ultrasonic probes capable of imaging from 'within' became available.



Ultrasound catheter within a blood vessel (left), and cross-sections of normal and diseased vessels obtained from ultrasound images.

These probes could be passed through natural orifices in the body, like the mouth, nose and anus, and advanced into hollow organs to study not only the detailed structure of their walls but also organs in their immediate vicinity. This new technique, endoluminal sonography, has found wide applications in the imaging of deeper parts of the heart through the oesophagus, the gastro-intestinal tract, and glandular organs like the prostate. Cross-sectional imaging of blood vessels using intravascular ultrasound is the latest addition to this list of applications.

The principal method of diagnosing diseases of blood vessels has been angiography, which was introduced in the thirties. Angiography is performed by introducing a needle or a plastic tubing into the blood vessels and injecting a contrast medium like iodinated organic compounds to render the blood within the vessels radio-opaque during X-ray exposure. While angiography is an efficient method of studying changes in the inner contour and lumen of blood vessels, it provides no information about the vessel wall. This is a serious drawback, since the early changes in atherosclerosis and other degenerative as well as inflammatory diseases of blood vessels are predominantly in the vessel wall, with little or no alterations in the luminal contour of the vessel. Intravascular ultrasound holds considerable promise in this regard, and the structure of the normal vessel wall and the alterations brought about by various disease processes can be well studied by this technique.

The hardware used for intravascular sonography consists of two major components, namely the catheter and the imaging console. The catheter is usually made of polyethylene, with a wire braid incorporated in its wall to prevent kinking. The transducer is made of a single element mounted at the tip of a rotary driving shaft. The transducer typically has a lateral aperture of one millimetre and is lens-focused to a depth of two millimeters. The motor rotating the transducer shaft has a speed of 900 rpm, i.e. 15 rotations generating 15 frames per second.

The imaging unit operates usually at 20 MHz or 30 MHz and is capable of generating 360° scan pictures. The spatial resolution is of the order of 200 to 400 μm. The images are recorded on videotape and are subsequently digitized for image manipulation and other post-processing functions.

The procedure is performed in much the same way as conventional angiography. Under local anaesthesia, the femoral artery in the groin is punctured through the skin with a needle and a French sheath is exchanged for the needle. The ultrasound catheter is advanced through the sheath under X-ray television control to the desired area and the image-generation procedure is started. Conventional angiography using standard anngiographic catheter is performed before ultrasonography and specific diseased areas of interest are identified for study by ultrasound. The entire procedure can be combined with therapeutic procedures like balloon angioplasty, laser angioplasty and stent placement. The results of these procedures can thus be documented[2].

The cross-sectional images of intravascular ultrasound delineate in considerable detail the structure of the vessel wall and the abnormalities within it[3]. In the normal blood vessel, the three layers of the vessel wall are clearly demonstrated owing to their different texture and echo density. In vessels afflicted with atherosclerosis, a number of changes have been observed. Firstly, the distinct three-layer pattern is obscured. Areas of calcification cause acoustic shadowing in much the same manner as kidney and gall bladder stones do in conventional ultrasound imaging. Lipid and fibrous plaques can be seen as elevated areas projecting into the vessel lumen. There are also programmes available for calculating cross-sectional diameter and area at any particular point on the vessel. More recently, facilities for three-dimensional reconstruction from a series of contiguous images have been developed.

Following therapeutic procedures for reopening blocked vessels, the portion of the artery subject to such procedures can be examined to check for adequacy of the lumen, irregularities and tears in the vessel-wall lining, and complications, if any, ensuing from the procedures.

While intravascular ultrasonography holds considerable promise, the technology currently available is not without its drawbacks[4]. The image resolution requires more refinement. The image obtained is that of a side view and forward viewing is not possible. This is a major flaw particularly for performing transcatheter therapeutic procedures. Until these problems are solved it is unlikely that this new method will totally replace the currently available conventional radiologic imaging techniques for studying blood vessels.

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